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Science

THE SCIENTISTS NEWSWEEKLY

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Harlow Shapley, newly elected president of the Association, who takes office on January 15, 1947. Shortly before his election was announced on December 29, Dr. Shapley delivered the Sigma Xi lecture, an annual feature of the AAAS meeting.

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Development of Natural Resources

H. H. Bennett

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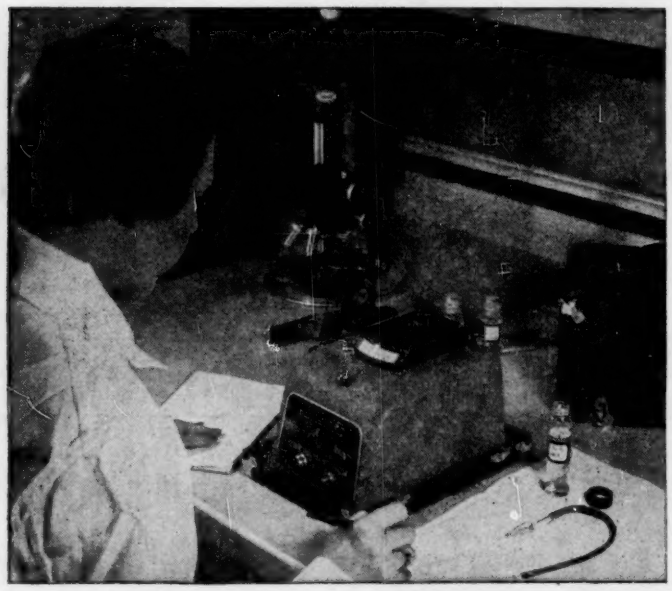

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OTHER NEW and REVISED MATERIAL

Wallerian degeneration has been described anew with some interesting points on regeneration of nerves after injury.
Cerebral cortex—localization of areas, and function
Cerebellum—recent work to show some degree of localization of function, etc.
Innervation of choroid plexus
Functional composition of the trigeminal pathways
New data on the cochlear, vestibular and optic nerves
New method of plotting dermatomes by sympathetic ganglionectomy
New classification of thalamic nuclei

By **Stephen W. Ranson, M.D., Ph.D.,** Late Professor of Neurology and Director of the Neurological Institute, Northwestern University Medical School, Chicago. Revised by **Sam Lillard Clark, M.D., Ph.D.,** Professor of Anatomy, Vanderbilt University School of Medicine, Nashville, Tennessee. 532 pages, 6½″ x 9¾″, with 417 illustrations, some in color.

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Science

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Development of Natural Resources:

The Coming Technological Revolution on the Land

H. H. Bennett, ***Chief, Soil Conservation Service, U. S. Department of Agriculture, Washington, D. C.***

PRODUCTIVE LAND IS UNLIKE ANY other natural resource. It is characterized by the element of life placed by Nature in the thin mantle of fruitful soil occurring over a limited portion of the earth's surface. It is this life-producing quality that makes some lands productive, and it is the absence of this quality that makes some barren.

Productive land is further differentiated from other natural resources in that it must be maintained and used simultaneously; that is, it must be kept intact while in use. All other natural resources, with very few exceptions, must be taken from the earth—separated from it—in order to be used by man. The exceptions are certain forms of wildlife and those natural areas which, because of their aesthetic values, are kept in their original state.

Productive land is much more limited than commonly has been supposed. It occurs only on the surface of the earth, and only on part of this surface. It is not permanent. Once the fertile topsoil is washed or blown away, it cannot be restored or replaced in any practical way for generations. And what is left—subsoil—usually is far less productive, or sterile, and less stable. There are no undiscovered reserves of productive land of any substantial area.

We cannot dig deeper into the earth and find new productive soil. We cannot pump it from wells, plant it with seeds, or dig it from mines. We must keep what we have or do without. Assorted residues of sand and gravel left stranded along streamways are of small value.

Productive land is the only natural resource without which we cannot live. We are completely dependent on it for the food we eat, except fish. We also depend on it for a very large share of our clothing and shelter. We cannot get enough to feed ourselves or provide our clothing from the oceans. On any large scale, hydroponics would be utterly impractical. We might conceivably turn sometime to some form of synthetic food, as pills, plus a roughage, but this appears to be a fantastic extreme, still far away, and likely, if it ever comes, it will be decidedly unpopular.

There is no doubt about the need for protecting productive land. Year after year, for generations, man has been steadily engaged in ruining millions and million of acres of this basic resource. Every hard rain falling on unprotected, cultivated, or overgrazed sloping land washes additional tons of soil downslope, downstream, into the rivers, reservoirs, and oceans. There is no practical way of bringing this back. And every hard wind, blowing across bare, dry soil, whether sloping or level, adds to the damage. Wind lifts the fine soil particles into the air and often develops huge dust storms that destructively scatter the substance of the land. What is left behind, frequently, is infertile, shifting sand that smothers out vegetation on neighboring good land.

When the world was younger and our population much smaller, we could, perhaps, stand such waste, but that time is past. It is not defeatism to say that the world is fast maturing and must assume now a mature responsibility for its resources. It is not limiting the horizons of the future to say that land exploitation must stop. It is simply a matter of common sense and self-preservation. Besides saving soil and water—the two go together—soil conservation results in increased yields per acre. It is also easier and cheaper to farm on the contour than up and down hill.

Today, throughout our world, there are left only about 4,000,000,000 acres of immediately arable land, the productivity of a great deal of which is only fair to medium. Some of it is poor. Yet we must count on all of it to feed a population reported to be in excess of 2,000,000,000, and still increasing.

The United States is somewhat better off, from the standpoint of productive land, than most nations. Even though we have ruined more good land in less time than any other nation in recorded history, we had the advantage of an unprecedented supply to begin with. Now we have little margin left, but we still have enough productive land if we take care of it. We cannot hope to maintain our present standard of living if we lose much more; eventually, if the losses should continue, the Nation would suffer even more seriously.

There are about 460,000,000 acres of really good, high-class cropland left in the United States. This includes, in addition to that now in crops, about 100,000,000 acres that need drainage, irrigation, clearing, or other improvements. All but about 70,000,000 of these 460,000,000 acres of high-grade land is subject to erosion if it is not protected. We have no reason for complacence.

Address given before the Engineering and Human Affairs Conference at the Princeton University Bicentennial Conference, Princeton, New Jersey, October 2, 1946.

Our record shows that we have ruined, for further practical cultivation, about one-fifth of our original area of tillable land. A third of what remains has already been badly damaged, another third is highly vulnerable, and the erosion process is still going on.

How did we get into this predicament? Why was this allowed to happen? Why didn't you hear about it sooner? There are a number of reasons, but probably the following are the main ones:

First, we began losing land to erosion when the world was still young. Those were the days when there was always more land—a great deal more—just over the hill or across the ocean. People came to regard land as limitless and inexhaustible. This deceptive idea persisted as time went by, and it was probably not until the United States was settled all the way to the Pacific Coast that people began to have any real doubts about the myth of land plenty.

Second, the apparent abundance of good land for so many generations gave rise to a careless and prodigal attitude. There was nothing of any compelling nature to cause a landowner to take care of his land or have concern about maintaining its productivity. New land somewhere could almost always be had.

Third, in modern times, the leaders of thought and nations—and nearly everybody else—too often have had little or no personal knowledge or understanding of the land. They have been trained in law, finance, philosophy, administration, military science, economics, education, or some field other than agriculture, and especially that part of agriculture having to do with maintenance of the base, meaning the land. With few exceptions they have had neither the incentive nor the training to look at the landscape around them and understand what was happening. The ancient and unchallenged myth of land plenty came down to them too, through the ages, and was accepted as truth.

Fourth, too much of the land traditionally has been in the hands of the untutored and the inept. In very recent years and in a very few countries, this situation has been changing, fortunately, for the better. However, over most of the world, land is still being used by men with little specialized or adequate training for the job. Too many land users have operated on a trial-and-error basis and have been influenced predominantly by habits handed down from the past, whether good or bad. Some have placed greater faith in superstition than in science. Under the names of peasant, farmer, rustic, and country fellow, these individuals have been synonymous, for generations, with all that is naïve, uneducated, and backward. Possessed frequently of such virtues as thrift and diligence, they have nevertheless often assumed a scornful attitude toward education and the educated, and too often the farm has been the last resort to which men, unsuccessful in other fields, have turned. In short, the most precious natural resource on earth in too many places has habitually been in the charge of those who have had no greater qualifications for the trusteeship than the coincidence of inheritance or birth on the land.

Fifth, too few farms have produced surplus capital for the owner over a period of years. On the contrary, the farm often has been no better than a marginal or subsistence enterprise. Even in the United States, the farmer rarely has had the personal resources to undertake research or seek out technological improvements. He has generally been almost wholly dependent on outside help, from government or private corporation, to provide him with improvements in machinery, materials, and methods.

Sixth, our agricultural scientists failed completely, over bygone years, to recognize land for what it is—an impermanent and complex resource. They considered soil permanent and synonymous with land. As a result of this mistake, both agriculture and the land suffered. Soil is but one part of land. For all practical purposes, land must be regarded in terms of all its component parts of soil, slope, climate, and susceptibility to erosion. The early scientists largely ignored erosion, paid little attention to slope, called the weather inevitable, and took soil samples right and left. In the main, however, agricultural science was not greatly concerned about the land. In large degree it was more interested in the health and breeding of livestock; improvement in strains of grasses, legumes, grains, and fibers; and modernization of machinery and equipment. All of this was beneficial, but it did neglect the capital stock of agriculture and the source of production—the land itself.

Seventh, in agriculture as in other enterprises we often wait until we are sick before we call the doctor. There is an element of human nature about this, and it has operated on the land. We did not practice preventive medicine, and now we must try to cure a malady —erosion—that has gotten into our system and weakened us.

So much for history. There is little to be gained by a review of past shortcomings except as it will help us avoid similar pitfalls in the future. Today we are profiting from the lessons of the past. We know now:

(1) That productive land is neither limitless nor inexhaustible. On the contrary, we have learned that the area of productive land is steadily shrinking before the onslaught of erosion.

(2) That land must be expertly cared for if it is to be maintained in a productive state.

(3) That productive land must assume an ever more prominent position in the thinking of the people and their leaders. As the source of food for all people, rural and urban, it must have the regular, intelligent consideration that such indispensable wealth merits.

(4) That, since society as a whole depends absolutely on the produce of the land for its present and future existence, society as a whole must share in the responsibility and cost of maintaining land in a productive state. The individual land-

owner or operator has neither the resources nor the ability to carry the burden alone, and he has control only for a lifetime.

(5) That science must inevitably devote an increasing share of its attention to the problems of maintaining the substance and improving the yield of productive land.

(6) That action is imperative. Time is running out between the impending pincers of an increasing population and a dwindling area of productive land.

(7) That the technological key to future consideration of land development is scientific analysis of each parcel of land of any important extent to determine: (a) the type of production for which it is best suited physically and economically, as between row crops, forage, trees, grain, or wildlife; and (b) the conservation measures, such as terracing, strip cropping, and contouring, necessary to maintain it in a permanently productive state under maximum use.

(8) That practical treatment must be based on this analysis—the character of the land and its needs.

Lands vary widely from place to place and even on parts of the same farm or field. Every variation in the combination of soil, slope, climate, and susceptibility to erosion means a variation in the use and treatment necessary to keep the land permanently productive. Thus, engineering measures are used to supplement agronomic and fertility measures wherever necessary, and vice versa, according to need, adaptability, and economic limitations.

This is the basic principle underlying the new land technology developed in the United States during the past 14 years by the Soil Conservation Service (first called Soil Erosion Service). It is being applied to an ever-increasing area of land by American farmers, acting with the assistance of Service technicians. By the middle of 1947 more than 100,000,000 acres in all parts of the United States will be farmed in this modern conservation way; that is, each of the 100,000,000 acres or more will be used according to its individual capabilities and will be treated according to its conservation needs.

In the United States, land technology is spreading through a new democratic device known as the soil conservation district. The district is a subdivision of State government, brought into being by a process of referendum among the landowners and operators involved. In practical application it is a legal organization of landowners and operators within a designated area for the purpose of developing and carrying forward a mutually desirable program of soil and water conservation. Its principal advantages are in the encouragement of local initiative and in the greater strength that comes with organized numbers—farmers and ranchers working together.

In soil conservation districts the farmers themselves decide what they want to do to improve their land and water resources and how they want to go about doing it. Then they proceed along this course, working together, and utilizing all the available facilities and services they can command. In almost every instance, districts are obtaining technical guidance from the Soil Conservation Service.

On August 15 there were more than 1,670 districts in the United States, voluntarily voted into existence by the farmers themselves. These districts encompassed more than 900,000,000 acres and approximately 4,000,000 farms. Farmers are continuing to organize districts at the rate of approximately 25 per month.

Although democratic soil conservation districts are being employed in the United States to further the application of land technology, other nations may choose to utilize other means. A number, however, including the Union of South Africa, Mexico, and parts of Australia, have adopted the soil conservation district method.

In the long run, the overwhelming urge of mankind for survival will dictate that every remaining productive acre be handled in such a way that it will continue to produce indefinitely. In the meantime, other factors are combining to speed up the application of technology to the land. From the standpoint of the individual and the nation alike, the development and application of soil and water conservation technology (the tool of soil conservation science) is good business. It results in greater yields and greater returns per acre for the capital and labor expended. Moreover, it maintains or improves the basic strength and self-sufficiency of individual and nation. It probably can prevent at least half the potential famines of the future.

By increasing the per-acre, per-farm, and per-nation supply of food and fiber, conservation technology can provide the basis for an improved standard of living and simultaneously reduce the hunger and discontent among peoples which so frequently leads to discord, dictatorships, and war.

For these and other reasons, the application of land technology is certain to spread around the world, either voluntarily or by decree. By the year 1996 this world journey probably will be well advanced. By that year or before, it will have accomplished changes in agriculture tantamount to a beneficial revolution on the land.

Almost certainly, productive land will have become a major factor in national and international deliberations. In all probability there would have been better international relationships if we had worked together more on ways and means of keeping land productive.

Production in the agricultural areas of the world will be more diversified; there will be pronounced increases in the acreages devoted to livestock and trees.

Agricultural production will be restored or improved in millions of communities throughout the world, solving in large measure some of the most difficult problems of food distribution and human nutrition now confronting mankind.

The nutritive value of food produced on land rich in the constituents of plant nutrition undoubtedly will be greater than that from impoverished land, which has

been stripped of its topsoil by erosion, with everything the topsoil contains: available elements of nutrition, both minor and major, all that man puts into the topsoil, and everything else. With so much eroded land around the earth, is there any wonder that malnutrition and famine are so widespread?

Development of land and water resources for agriculture, as by drainage or irrigation, will be governed primarily by factual, technological elements of land use and land maintenance rather than by promotional, exploitive, or political standards.

Also, people will learn that it is easier on machine, horse, and man to farm according to conservation standards than to follow haphazard methods not fitted to the land. Less fuel and time, for example, are required to operate a machine on the level, on the contour, than up and down slopes, and there is less wear on the machine.

The heavy costs of erosion, now running to approximately $3,844,000,000 a year in the United States alone, will be sharply cut.

Farming will become an expert profession; the inexpert and inept will be forced off the land. It is not impossible that the prospective farmer of the future will be required to satisfy society that he is qualified by training and experience to take on the trusteeship of a piece of productive land.

Most important, man will have learned the true value of his most precious natural resource. Tragically, throughout history, the land has been the most neglected.

On this job of safeguarding the land, thousands of farmers, in addition to various local, state, and federal agencies, are vigorously pushing ahead with the work. Each individual so engaged is a part of the biggest job, I think, in engineering and human affairs ever undertaken anywhere.

Do Certain Drinking Waters Favor Dental Caries?

Henry Klein, *Division of Public Health Methods, U. S. Public Health Service, Bethesda, Maryland*

IT IS NOW GENERALLY RECOGNIZED that children who consume drinking waters containing from 1 to 2 ppm of fluoride (F) during the first decade of life have a lower experience with dental caries than do comparable children consuming nonfluoride waters.[1] It is the purpose of the present note to describe findings which suggest that drinking waters may contain deleterious factors which *favor* attack by dental decay.

During the winter and spring of 1946, with the cooperation of Dr. J. M. Wisan, chief of the Division of Dental Health, New Jersey Department of Health, and with the assistance of Dr. John F. Cody, senior assistant dental surgeon, U. S. Public Health Service, a total of more than 3,000 school children were examined in five communities of southern New Jersey. In three of these communities the water supplies contain from 1.4 to 2.2 ppm of fluorine, while the remaining two communities have water supplies which are considered fluorine-free. (The water analyses were made by Dr. Elias Elvove, senior chemist, U. S. Public Health Service.)

Of the approximately 3,000 children, 1,307 were born in localities outside the five communities studied, but had migrated at various ages into the several communities where the examinations were made. Those migrating into the fluorine communities and consuming the fluorine waters continuously since first arrival totaled 882, while those migrating into the nonfluorine communities and consuming the nonfluoride waters continuously totaled 425. What effect do these two types of drinking water have on the caries attack rate of the migrants?

TABLE 1

NUMBER OF DECAYED, MISSING, AND FILLED (DMF) TEETH PER 100 PERSON-YEARS OF AGE FOR MIGRANTS INTO FLUORIDE AND NONFLUORIDE AREAS OF NEW JERSEY*

Age (years) at time of survey	Area in New Jersey	Duration of exposure (years)		
		0–4	5–9	10–14
5–9	Fluoride	8.6	5.5	†
	Nonfluoride	19.3	20.3	†
10–14	Fluoride	36.7	22.2	15.5
	Nonfluoride	37.6	44.3	57.5
15–19	Fluoride	56.6	43.3	33.3
	Nonfluoride	49.6	61.1	70.0

* Data based on observation of 1,307 migrants of both sexes of specified ages and of specified duration of continuous exposure to the city water in the specified areas.

† No observations.

The caries attack rate for the present study is defined as the number of teeth of the permanent (second) dentition showing evidence of past or present attack by dental caries (decayed, missing, or filled) per 100 person-

[1] "Fluorine in Dental Public Health": Symposium-Conference of the New York Institute of Clinical Oral Pathology, October 30, 1944, New York City.

years of age. The findings are given in Table 1 and Fig. 1.

The data clearly show that the sooner after birth a child arrives in the fluoride area and begins a continuous exposure to fluoride water, the lower the caries attack rate. From these findings the conclusion is reached that, for migrants, drinking of fluoride waters is associated with lower dental caries attack rates. At the same age, migrants protected most are the earliest to arrive (longest exposed); those protected least are the most recent arrivals (shortest exposed).

In contrast, migrants into the nonfluoride area present a strikingly different picture. Among such migrants, those who are the most recent arrivals have the best teeth (lowest attack rate), while those who have been in the nonfluoride area the longest time have the worst teeth (highest attack rate).

These several findings strongly suggest that, just as there are factors in drinking water which favor *resistance* to tooth decay, there may be factors in drinking water which make the teeth *more vulnerable* to dental caries. Search for the principles in the nonfluoride waters responsible for the described effects is now actively under way. Superficial examination indicates that the nonfluoride waters in this area are acid enough to require treatment with alkali, and they contain excess iron to such an extent that aeration is required to remove it. Preliminary chemical analysis indicates an unusually high content of nitrates, constituting more than one-half of the fixed residue.

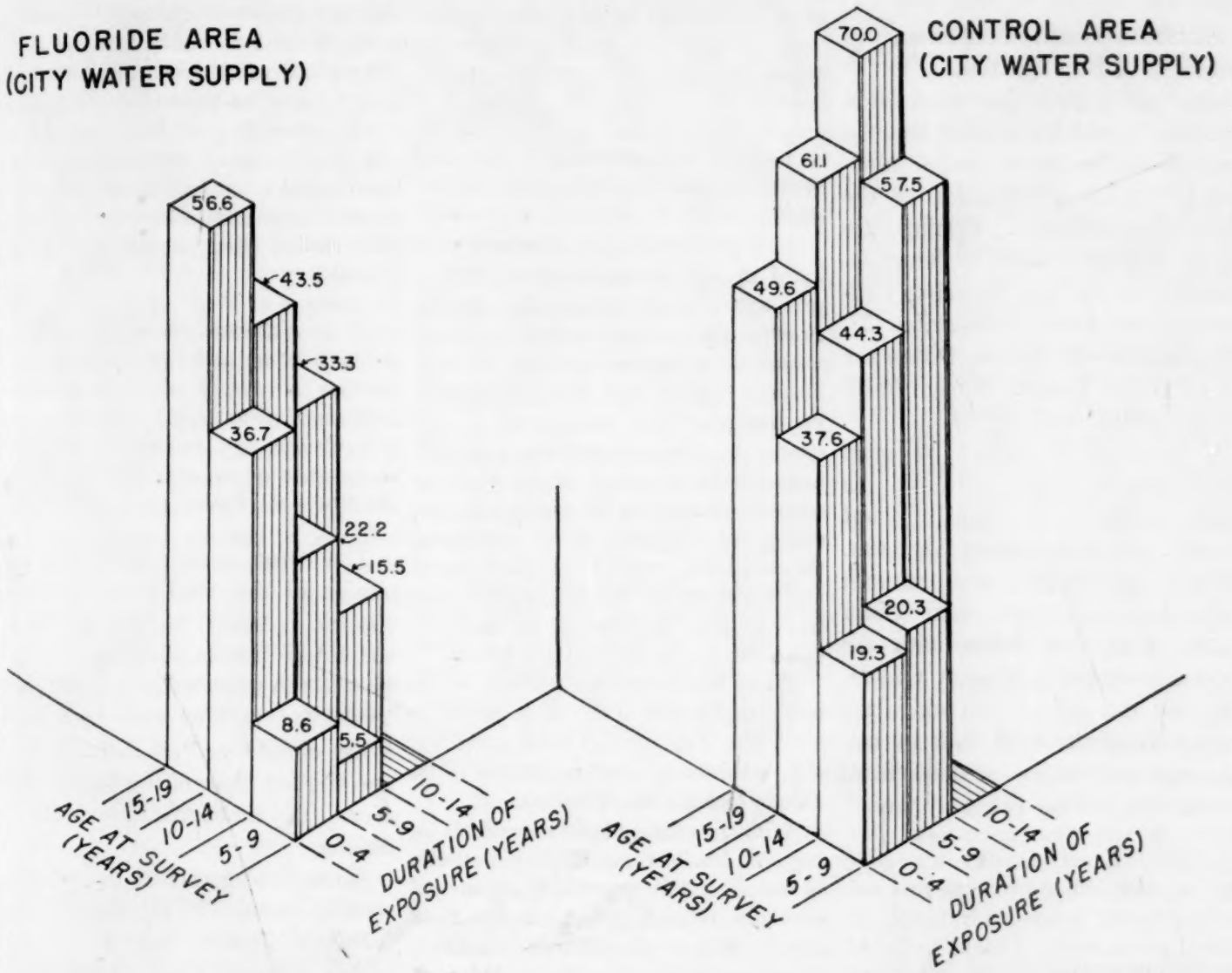

FIG. 1. Relationship between duration of exposure to fluoride or nonfluoride drinking water and number of decayed, missing, and filled (DMF) permanent teeth per 100 person-years of age in migrants of specified ages. (Numbers on tops of columns equal number of DMF permanent teeth per 100 person-years of age.)

Scanning Science —

It is reported by cablegram that Alfred Nobel, the engineer and chemist, who died at San Remo, Italy, on December 9th [*sic*], left a will bequeathing his entire fortune, amounting to about $10,000,000, to the Stockholm University.

—*January 1, 1897*

NEWS *and Notes*

President Conant called on science writers to help in interpreting to the general public both the "need for a National Science Foundation and the basic conditions for its proper functioning" in his presentation of the 1946 AAAS-George Westinghouse Science Writers' Award to James G. Chesnutt, of the San Francisco Call-Bulletin, on Friday, December 27. The program was broadcast from the Statler Hotel, Boston, through WBZ and associated stations.

In speaking to some 150 press representatives who attended the award luncheon, President Conant pointed out that during the war, colleges, universities, and research institutions had come into closer contact than ever before with the Federal government through OSRD. "No one can deny," he said, "the importance of the work done by colleges and universities for the Federal government during the war years."

"Today, fifteen months after V-J Day we still find the colleges and universities having many dealings with the Federal government. Thanks to the so-called G.I. Bill, large numbers of veterans are receiving college and university education with substantial subsidies from the Federal government. We are in effect operating our colleges with a Federal scholarship program for those who served in the armed forces of the country. But that is another story.

On the research side many institutions are operating research contracts with the Army and the Navy though on a non-secret basis. The leaders of the armed forces have been farsighted in supporting such basic research, but this is presumably not the final answer to channeling Federal funds.

It is natural for those concerned with the future of advanced education to wonder what lies ahead after the period of demobilization is over. Is Federal money to continue to flow to our institutions of advanced learning? If so, how can we avoid the development of a centralized control of higher education which everyone admits would be most unfortunate. In looking into the future, it seems important for all of us to think as clearly as possible about the relation of our educational institutions to the Federal government. This is no simple problem, the answer to which can be summed up in a headline or a few *clichés*. Rather, it is one of those intricate problems in the organization of modern society that needs careful analysis and thoughtful consideration.

In a very challenging document published by the government more than a year ago, entitled *Science, The Endless Frontier*, there was set forth a strong argument for the establishment of a new Federal agency, the National Science Foundation. This agency was to be erected by Congress and supplied with funds for the purpose of supporting basic scientific research in the universities and colleges of the land. A bill embodying the essential features of this report passed the Senate at the last session, but time was too short to permit of its final consideration on the floor of the House.

I very much hope that this bill, or one very closely related to it, will be passed by the coming Congress. It seems to me that it is a matter of great importance to the country that this should be done.

With the record of the war behind us, one need hardly argue for the importance of basic scientific research as an integral part of a national defense program, and alas, in the type of world we now live it is necessary to consider the problems of national defense. Until such time comes when we can drastically reduce our Army and our Navy and our Air Force, until such time comes that we are living in a world where problems of national security are no longer of major importance, the government clearly must support the development of basic scientific research and the education of scientific workers if for no other reason than because of the importance of these activities in terms of the total military picture. There is, of course, another important reason, or rather two, for the Federal support of scientific research, namely, the fact that the development of modern industry on the one hand, and modern medicine on the other, are tied closely to the development of modern science.

When this National Science Foundation is created, as I hope it will be, it will be in a position to make grants of money to the universities for the support of the very expensive basic research in such sciences as physics, chemistry, biology, geology, psychology. Such grants would be in no way connected with direct military projects. Indeed, in time of peace I think it highly inadvisable for universities which are dedicated to free investigation to undertake the type of investigation they did during the war for patriotic reasons, namely, secret or confidential work. All secret research in days of peace should be done in government laboratories, arsenals, and proving grounds.

If the National Science Foundation is properly set up and properly managed, I have no fear myself that there will be any deleterious effects to the universities even if they receive very large sums of money for the support of scientific research by this route from the Federal government.

The event marked both the conclusion of the 1946 award year for the science writers and the opening of the AAAS Boston Meeting. In addition to the winner of the $1,000 cash award, honors also went to Stephen White of the *New York Herald Tribune* and Herbert Shaw of the *Dayton Daily News*, as announced previously in *Science*.

Among the guests at the luncheon were Admiral H. G. Bowen, Vice Admirals Parsons and P. F. Lee, Major General Curtis LeMay and Malcolm Grow and Charles F. Kettering, whose address as retiring president on the evening of the 27th was printed last week in *Science*.

The Council announced the election of Harlow Shapley as president for 1947 and E. W. Sinnott, president-elect. The new constitution provides that the president-elect shall take office as president in 1948. On January 15 President Conant, who presided at the Boston meeting, will become the chairman of the Executive Committee. From this time on the services of one man are continuous for three years as president-elect, president, and chairman of the Executive Committee.

Following the announcement of the election results for 1947, the Council passed a resolution calling for the formation of an Inter-society Committee for a National Science Foundation, appropriated funds for starting the organization, and instructed the appropriate AAAS officers to extend an invitation to other national educational and scientific societies to participate in the new effort to secure some action in the present Congress.

The resolution was prepared by a Council committee, Kirtley F. Mather, chairman, Harlow Shapley, Joseph Boyce, George A. Baitsell and Stuart Mudd, appointed on December 26. The resolution said in part: "For many years the Government has wisely supported research in the agricultural colleges and the benefits have been great. The time has come when such supports should be extended to other fields of science and to advanced scientific education. There is not now in the governmental structure any civilian agency, receiving its funds from the Congress, adapted to providing the necessary supplementation of funds or the necessary additional support of basic research in medicine, national defense research or basic sciences, or adapted to administering a program for the support of advanced scientific education."

About People

John J. Brown has been appointed chief of the Design Branch, Plants Division, Technical Command, Edgewood Arsenal, Maryland. During the war Lt. Col. Brown was in the Chemical Corps and was transferred to the Corps of Engineers for work on the India-China pipe line.

Aaron F. Bracken, professor of agronomy at the Utah State Agricultural College, left on December 1 to assume his duties as agricultural adviser to the Syrian Government.

Frederick F. Yonkman, director of research at Ciba Pharmaceutical Products, Inc., Summit, New Jersey, addressed the Medical Association of Puerto Rico during its annual meeting, held December 11–15. His topic was "Antibistaminic Agents: A New Approach to the Treatment of Allergy."

S. Francis Howard has retired as head of the Chemistry Department, Norwich University, Northfield, Vermont, following 50 years of teaching, 33 of which were spent at the University. P. D. Baker has been appointed his successor.

Wendell M. Stanley, of the Rockefeller Institute for Medical Research, who was named as a 1946 Nobel Prize winner in chemistry (see *Science*, 1946, **104,** 483) is writing a book on virus diseases, to be published soon by Princeton University Press.

J. A. Southern, of Furman University, has been elected secretary-treasurer of the South Carolina Academy of Science.

George M. Maxwell has been appointed assistant professor of biology at the Jersey City Junior College, New Jersey. Previous to this appointment he was head of the Department of Biology and acting head of the Chemistry Department at St. Peter's College, professor of histology and embryology at Fordham University, and head of the Department of Biology at Marymount College.

Freeman S. Howlett, professor of horticulture, and member of the Ohio State University staff since 1929, has been named acting chairman of the Department of Horticulture and Forestry, following the recent death of Joseph H. Gourley.

J. B. Austin has been named director of the Research Laboratory of the United States Steel Corporation of Delaware, succeeding John Johnston, who has retired. Dr. Austin, formerly assistant director, has been associated with Dr. Johnston at the laboratory since its inception in 1928.

Robert De Vore Boche has been appointed assistant professor jointly in the Department of Zoology and in the Institute of Radiobiology and Biophysics, University of Chicago.

Ross C. MacCardle recently resigned his position as assistant professor of anatomy at Washington University, St. Louis, to accept appointment as cytologist in the National Cancer Institute, Bethesda, Maryland.

Kenneth B. Disher was appointed director of the Cleveland Museum of Natural History, effective October 16. He was formerly executive secretary of the Allegheny State Park Commission, New York, and previously had been associated with the Department of the Interior.

Katherine H. Heinig, instructor in botany at Wells College from 1937 to 1945, is now at Connecticut College, New London, as an assistant professor in the Department of Botany. Miss Heinig did graduate work at Cornell University in 1945–46, completing the work for her doctorate during the past summer.

Charles Mayo Goss has been appointed professor and head of the Department of Anatomy at the School of Medicine, Louisiana State University, and will join the faculty on February 1, 1947. He has been head of the Department of Anatomy at the University of Alabama since 1938.

Charles M. Riley has been made Longyear Fellow in Metalliferous Economic Geology at the University of Minnesota. The Longyear Fellowship was established by the E. J. Longyear Company, Minneapolis, in the spring of 1946 for basic research on the problems of finding hidden ore bodies by geological, geophysical, and other means. His work will be under the direct advisership of Frank F. Grout.

Walter Ramberg has been named chief of the Engineering Mechanics Section of the National Bureau of Standards, according to E. U. Condon, director. Dr. Ramberg, who has directed the Bureau's aeronautical research program since 1937, succeeds H. L. Whittemore, who recently retired after 29 years service at the Bureau.

Harold A. Abramson, assistant professor of physiology, Columbia University, was recently awarded the Legion of Merit for research activities as a medical officer assigned to the Chemical Warfare Service. In the description of services performed, emphasis is placed upon the fact that in 1942 Dr. Abramson initiated the project on, and subsequently directed the research pertaining to, penicillin aerosol therapy of the lungs.

W. Ewart Williams was named as a consulting physicist on Bausch & Lomb Optical Company's research and engineering staff on November 26. A resident of Pasadena, California, since 1939, Dr. Williams is an authority on interferometry, the phase of physics dealing with the measurement of wave lengths of light. Prior to coming to the United

States, he taught physics and optics at King's College, University of London, for 17 years, and also served as research physicist for Adam Hilger, Ltd., manufacturers of scientific optical equipment.

Gordon Gunter, on leave of absence from the Institute of Marine Science, University of Texas, is currently visiting professor in the Department of Zoology and research associate in the Marine Laboratory, University of Miami, Florida.

Edwin P. Hiatt, School of Medicine, University of North Carolina, has received a grant from the Cinchona Products Institute for continuation of his work on the effects of quinine and other cinchona alkaloids on renal function and blood pressure.

Harold C. Urey, traveling abroad at present, delivered the Liversidge Lecture for the Chemical Society in London December 18 and repeated the lecture in Edinburgh December 19. On December 14 Dr. Urey received the honorary degree of D.Sc. from Oxford University.

C. Jayaratnam Eliezer, 26, research fellow at Cambridge University, England, won the $2,000 Mayer Award for an essay on the nature of light, "The Interaction of Particles and an Electromagnetic Field." The prize was administered by the National Science Fund, National Academy of Sciences, of which Harlow Shapley is chairman. Dr. Eliezer, a native of Ceylon, taught at the University of Ceylon from 1943–1946. While at Christ College, Cambridge, he won the Smith Prize in mathematics.

Donald W. Kerst, University of Illinois, received the John Scott Award on December 19 for his invention of the betatron. The $1,000 prize was presented to Dr. Kerst in Philadelphia, where on November 16 he received for the same invention the Cyrus B. Comstock Prize of the National Academy of Sciences. Dr. Kerst's first betatron went into operation at the University of Illinois July 15, 1940. The John Scott Medal Fund derives from a gift of John Scott, chemist, St. Patrick's Square, Edinburgh, Scotlant, to the city of Philadelphia in 1816. The original bequest was $4,000, a sum which had grown to $100,000 by 1917 when court action was taken to increase the amount of annual awards from the original value of $20.

Ernest M. Stoddard, for 57 years plant pathologist at the Connecticut Agricultural Experiment Station, has been awarded the 1946 Certificate of Distinction given annually by the Connecticut Pomological Society for outstanding achievement in the field of pomology. The award was presented at the annual dinner of the Pomological Society in Hartford on December 10, when the presentation address was given by Sherman P. Hollister, professor emeritus of horticulture at the University of Connecticut.

Lauriston S. Taylor, chief of the X-Ray Section, National Bureau of Standards, has been awarded the Medal of Freedom for work on improved methods of bombing and bombing accuracy in the European theater, the Bureau of Standards has announced. At the same time Mr. Raylor received the Bronze Star Medal for "outstanding leadership, analytical ability, and technical skill in prosecution of the war." As chief of the Operational Research Section of the Ninth Air Force, Mr. Taylor headed a civilian group of scientists in work on bombing accuracy, selection of bombs and fuses, radar, radar countermeasures, selection methods for lead crews, and blind bombing.

Mr. Taylor joined the Bureau in 1927 and became chief of the X-Ray Section in 1941. Prior to service in Europe he was active in development of the radio proximity fuse.

Four biologists have been elected to the Academy of Sciences of the USSR, according to Science Service. The new members of the Academy are Boris Isachenko, Konstantin Bykov, Alexander Oparin, and Nikolai Maximov. Boris Isachenko, a microbiologist, is an arctic explorer and student of bacteria of the Arctic Ocean. He has published works on mycology and the role of microorganisms and self-heating of grain and peat. A student of Ivan Pavlov, Konstantin Bykov has extended Pavlov's teachings on the higher nervous system. Prof. Oparin is the author of a new theory of the origin of life and has done research in plant biochemistry and fermentology. Prof. Maximov, director of the Institute of Physiology of Plants of the Academy and head of the Timiryazev Agricultural Academy, has studied the resistance of plants to drouth and frost.

Robert B. Kleinhans, formerly head of the Department of Biology, Athens College, Athens, Greece, who served as a lieutenant commander at the U. S. Naval Academy and with the Allied Mission for Observing the Greek Elections, is now assistant professor in biology and director of the Beal-Maltbie and Thomas R. Baker Museums, Rollins College, Winter Park, Florida.

William Parks Yant has been chosen as the 1946 recipient of the Pittsburgh Award, bestowed annually by the Pittsburgh Section of the American Chemical Society for outstanding service to chemistry. Dr. Yant, director of research of the Mine Safety Appliances Company, has "contributed prolifically to Pittsburgh's science, industry and welfare," according to Dean Herbert E. Longenecker of the Graduate School of the University of Pittsburgh, chairman of the Section.

John V. Scudi has been appointed director of research at the Pyridium Corporation, Nepera Park, New York. Dr. Scudi was formerly head of the Biochemical Research Laboratories at Merck & Company, Inc., and more recently was assistant professor of pharmacology at the College of Physicians and Surgeons, Columbia University. Edmund T. Tisza, who has been director of research for the past 20 years, will continue in active service as technical adviser to president.

Mary Louise Forgach has joined the research staff of the Smith, Kline, & French Laboratories, Philadelphia.

Graham DuShane, formerly of University of Chicago, has been appointed professor of biology, Stanford University.

W. Taylor Sumerford, formerly of the University of Georgia, has been added to the faculty of the Chemistry Department, Louisiana State University, with the rank of associate professor.

E. Newton Harvey, Princeton University, gave a series of seminars and lectures during the week of December 2 at Ohio State University, under the auspices of The Graduate School and the Society of the Sigma Xi.

Sir Robert Robinson has accepted the invitation of the Council of the Chemical Society to deliver the Faraday Lecture during the Society's Centenary Celebrations in July 1947. The Faraday Lectureship was founded in 1867 to commemorate Michael Faraday, who was elected a fellow of the Society in 1842 and was one of its vice-presidents.

Awards

Tom Fite Paine, Jr., Aberdeen, Mississippi, has been awarded a research fellowship for the year beginning July 1, 1947 under the sponsorship of the American College of Physicians. The fellowship provides for the continuation during this period of the study of infectious diseases, with particular regard to chemotherapy and the use of antibiotics, in which Dr. Paine is currently engaged at the Thorndike Memorial Laboratory, Boston City Hospital, under the supervision of Maxwell Finland.

The Mayo Foundation for Medical Education and Research was awarded the annual citation of the American Pharmaceutical Manufacturers' Association at a program in New York City on December 9. The citation read: "In recognition of its great contributions to public health, by fundamental research in the field of the medical sciences, for the profound and lasting benefit of mankind."

Last year the award went to the Rockefeller Institute for Medical Research, for broad research in the field of the medical sciences.

This year Isaiah Bowman, president of Johns Hopkins University, made the presentation address, on "Contributions of Chemistry and Physics to Medicine," while Donald C. Balfour, director of the Mayo Foundation for Medical Education and Research, gave an acceptance address on "Eras in Medical History."

Industrial Labs

Compulsory retirement on a calendar age basis should be abandoned, Theodore G. Klumpp, president of the Winthrop Chemical Company, New York, told the American Public Health Association at its annual meeting on November 14. Noting that the adult population was steadily increasing in proportion to the total population, Dr. Klumpp predicted that by 1980 "there will be not less than 60,000,000 Americans 45 years and over and more than 21,000,000 who are 65 and over."

Recognizing the social problems implied in the increase in the adult population, Dr. Klumpp offered this 7-point program:

(1) Since physiological age is not synonymous with chronological age, compulsory retirement on a calendar age basis should be abandoned.

(2) Since hiring is selective and based on fitness to do a given job, retirement should likewise be selective and based on unfitness.

(3) Compulsory retirement should be based on the recommendation of a retirement board composed of medical and psychiatric members as well as administrative officials.

(4) If wage in proportion to performance is recognized as a fundamental principle, the older worker should taper off in industry, just as the young apprentice gradually works himself up in skill, performance, and remuneration. In other words, opportunities for downgrading in position and salary should be offered.

(5) Industry, and governmental and private institutions, must make a greater and more intelligent effort to employ partially disabled persons.

(6) When the aged and disabled have work to do, they are less of a burden, financially, socially, and spiritually, to those at home. Other things being equal, home environment is better than an institution for the aged and disabled.

(7) Institutions for the aged and disabled must be changed from asylums to modern institutions where every convenience and scientific development is available for their physical, mental, and spiritual comfort.

"Society," Dr. Klumpp said, "has been quite illogical and inconsistent in its attitude toward the older worker. On the one hand, we have no objection to electing and appointing older individuals to positions of the greatest responsibility in government, business, and the professions. And yet, as far as the rank and file of workers is concerned, we impose blind and unselected compulsory retirement rules which automatically eliminate those in the ranks who have reached a certain age regardless of their fitness, ability, and contribution to the group for which they labor."

The Miles Laboratories, Elkhart, Indiana, has made a grant-in-aid of $7,075 for blood grouping studies and research on antibiotics in Utah plants, under the direction of G. A. Matson, associate professor, Department of Bacteriology, University of Utah School of Medicine.

The Council on Industrial Health, American Medical Association, Chicago, has appointed Ernest W. Brown (MC), U.S.N., recently retired, executive officer for the Council's Committee on Scientific Development. He will be concerned mainly with industrial medical education and industrial toxicology. During the war Captain Brown was attached to the Office of the Surgeon General of the Navy in charge of industrial hygiene research, submarine medicine and chemical warfare medicine. He also served as liaison officer to the committees on industrial medicine and armored vehicles of the NRC.

Universities

Two new professorships in the Practice of Engineering, substantially analogous to clinical professorships in medical schools, giving recognition to the services of engineering practitioners, have been established by Harvard University in its Graduate School of Engineering.

Karl Terzaghi and Howard M. Turner are the first holders of these professorships in civil engineering. Prof. Terzaghi has been with the Graduate School of Engineering as lecturer on soil mechanics and engineering geology since 1938; Prof. Turner has been lecturer on water power engineering since 1919.

The University of Wisconsin recently purchased for $300,000 the extensive scientific library of the late Chester H. Thordarson, electrical manufacturer and inventor. The library contains 11,000 volumes, 60 per cent of which are scientific.

West Virginia University College of Agriculture, Division of Forestry and Home Economics, has recently acquired a new building for the use of the Forestry Division and the Department of Agricultural Engineering, enabling expansion of both the work and facilities of these units.

The 75th anniversary of the Missouri School of Mines and Metallurgy was commemorated recently in Rolla, Missouri, by an academic convocation at which Frederick A. Middlebush, president of the University of Missouri, presided. Eugene McAuliffe, chairman of the Board of Trustees, Union Pacific Coal Company, delivered the principal address on "The Engineer's Contribution to Society and the World." Honorary degrees in engineering were conferred upon James Presley Gill, vice-president of the Vanadium Alloys Steel Company, and Herbert Russell Hanley, professor emeritus of Metallurgical Engineering at the Missouri

School of Mines and Metallurgy. Established in 1871 and maintained jointly by the State of Missouri and the Federal Government under the provisions of the Morrill Act of 1862, the School has provided technical and scientific education to more than 10,000 students, with instruction in seven major departments.

New York University has announced, through Chancellor Harry Woodburn Chase, a special emergency supplementary payment of $400 to all full-time members of the teaching and administrative staffs of the institution, under Council appointment, in active service since September 1, 1946, and still serving at the time the payment will be made, January 1, 1947. Supplementary emergency compensation of varying amounts, based on length of service, has also been voted to members of the clerical, laboratory, and plant staffs in continuous employment from September 1, 1945, to the time of payment. It was estimated that the special disbursement would cost the University between $500,000 and $600,000.

Meetings

The American Association of Junior Colleges will hold its 27th annual meeting February 19–22 at the Hotel Jefferson, St. Louis.

The Antibiotics Study Section of the National Institute of Health will meet in Washington, D. C., on January 31 and February 1 together with commercial producers of antibiotics and others interested in antibiotic research. All interested investigators are invited to attend. Inquiries about the meeting and presentation of reports should be addressed to Gordon Seger, Dr. P. H., Antibiotics Study Section, National Institute of Health, Bethesda 14, Maryland.

The Chemical Corps Technical Command held a conference on turbulent diffusion on November 16 at Edgewood Arsenal, Maryland. Among those taking part was a panel of consultants including P. A. Leighton, dean of the School of Physical Sciences, Stanford University; A. H. Corwin, head of the Chemistry Department, Johns Hopkins University; and H. F. Johnstone, head of the Chemical Engineering Department, University of Illinois.

The Association of Medical Illustrators, which was organized in Chicago in July 1945, held its first annual convention in Philadelphia the week of September 23, 1946. The stated purpose of the organization is "to promote the study and encourage the advancement of medical illustration and allied fields of visual education; to advance medical education; and to promote understanding and cooperation with the medical and related professions."

The American Mathematical Society held its 419th meeting at Princeton University on November 2, in connection with the year-long celebration of Princeton's bicentennial. The attendance was approximately 250, including 217 members of the Society. Forty-nine research papers were presented, 18 in person and 31 by title. By invitation, an address entitled "Combinatorial Homotopy Theory" was given by J. H. C. Whitehead, Waynflete professor of pure mathematics at the University of Oxford. In the evening, under the auspices of Princeton University, an informal discussion of the current state of mathematics throughout the world was held. Einar Hille presided, and brief talks were given by Harald Cramér, Claude Chevalley, Solomon Lefschetz, H. P. Robertson, and Marston Morse.

The National Malaria Society, at its 29th annual meeting at Miami, Florida, on 4–7 November, adopted a new constitution and by-laws and elected the following officers: president, Mark D. Hollis; president-elect, E. Harold Hinman; vice-president, Wendell Gingrich; secretary-treasurer, Martin D. Young; and board of directors, Justin M. Andrews (one year), L. W. Clarkson (two years), and W. H. W. Komp (three years).

The Tennessee Academy of Science, at its annual meeting on November 30, elected the following officers for the coming year: president, Paris B. Stockdale, head of the Department of Geology and Geography, University of Tennessee; vice-president, W. M. Deacon, head of the Department of Biology, Vanderbilt University; secretary-treasurer, James G. Walls, assistant professor of geology, University of Tennessee; AAAS councillor, Clinton L. Baker, head of the Department of Biology, Southwestern University; and editor, Jesse M. Shaver, head of the Department of Biology, George Peabody College for Teachers.

The Academy of Natural Sciences of Philadelphia has published Volume I, Part 2, of Land Mollusca of North America (North of Mexico), by Henry A. Pilsbry. This two-part monograph will be completed with the publication of Volume II of Part 2 in 1947. The first volume of Part I appeared in 1939 and the second in 1940. Completion of the work was delayed by the war. Dr. Pilsbry, 84 on December 8, has been a member of the Academy's scientific staff for 60 years. He is still an active field collector and has recently been on an expedition to Guatemala, traveling by air.

The American Academy of Tropical Medicine held its 13th annual meeting at Hotel Alcazar, Miami, Florida, on November 6, in conjunction with the Southern Medical Association and in association with the American Society of Tropical Medicine. Lowell T. Coggeshall, University of Chicago, presided, and Brig. Gen. James S. Simmons, dean of the School of Public Health, Harvard University, delivered the annual presidential address on the subject, "Tropical Medicine and the Challenge of Global Peace." At the annual business sesssion of the Academy the following persons were elected to membership: Col. Karl R. Lundeberg (MC), USA, Washington, D.C.; Oliver R. McCoy, Rockefeller Foundation, Paris, France; Gilbert F. Otto, Baltimore, Maryland; and Capt. James J. Sapero (MC), USN. Officers elected for 1947 were: president, George K. Strode, Rockefeller Foundation, New York City; vice-president, George C. Shattuck, Harvard Medical School; secretary, Ernest Carroll Faust, Tulane University; treasurer, Jean A. Curran, Long Island Medical College; and councillor for a five-year term, Justin Andrews, Communicable Disease Center, U. S. Public Health Service, Atlanta, Georgia.

The 1947 Broadcast Engineering Conference sponsored by the departments of engineering at the University of Illinois and Ohio State University has been cancelled due to crowded conditions and lack of personnel. The 1947 conference was to have been held at the University of Illinois.

The American Society of Photogrammetry, a group of aerial photographic, mapping and charting experts, will hold its winter meeting January 22–24 in Washington, D. C., at the Wardman Park Hotel. Gerald Fitz Gerald, U. S. Geological Survey, president of the

society for 1946, will be succeeded by Revere G. Sanders of the Fairchild Camera and Instrument Corporation.

A fellowship for graduate study in geology has been established at Yale University by the Stanolind Oil and Gas Company. The fellowship is open to students whose interest is either in general geology or in any branch of the subject that has logical application to the petroleum industry. A student appointed to the fellowship will have no obligation in his choice of employment following graduation. For the year 1946–47 the fellowship has been awarded to James Lee Wilson, who received his Master's degree from the University of Texas in 1944.

The Department of Botany, Wellesley College, announces that Harriet B. Creighton, lieutenant in the Navy for the past three years, has returned and been made chairman of the Department. Other recent additions to the staff are Lora Bond, formerly of Drury College, Springfield, Missouri, and the University of Wisconsin, and Helena A. Miller, formerly of Connecticut College, New London, and Harvard University.

CARE packages totaling more than one and a third tons have been sent by ornithologists in Canada and the United States to their European colleagues in the past few weeks. Attention of scientists in Canada and the United States has been called to the needs of many colleagues abroad who still face starvation conditions, and the suggestion made that scientific societies purchase food packages available through The Cooperative for American Remittances to Europe. CARE is a non-profit organization through which individuals and organizations may order standard food packages at $10 for delivery in Austria, Belgium, Czechoslovakia, Finland, France, Greece, Italy, The Netherlands, Norway, Poland, the American, British and French zones of Germany, and all of Berlin. Standard food packages, obtained by CARE through the War Assets Administration, are called the "10-in-1" because they were originally designed by the U. S. Army to feed soldiers in groups of ten. An average of over 40,000 calories of balanced foods are included, which will feed a family of four a 2800 calory meal each day for two weeks. Further information and order blanks may be obtained from CARE, 50 Broad St., New York 4, N. Y.

The National Research Council of Canada recently listed the activities of its newly formed Committee on Dental Research, organized to stimulate and coordinate dental research in Canada. Projects now under way are: investigation of chemical mechanisms involved in decrease of dental caries by fluorides; chemical studies of nitrous oxide for dental anesthesia; investigation of packing materials in treatment of periodontal disease; improvement of certain properties of the acrylic resin denture base; study of effects of altitude, acceleration, and deceleration on oral tissues; investigation of effects of certain chemicals on materials in appliances used in prosthetic dentistry.

A reconnaissance party representing the National Geographic Society and the U. S. Army Air Forces has selected Bocayuva, State of Minas Geraes, Brazil (17° 15′ South Latitude, 43° 42′ West Longitude), as a site for the observation by a party of American scientists of the total eclipse of the sun on 20 May 1947. The point chosen is on a plateau at an elevation of 2,300 feet, about 400 miles north of Rio de Janairo. The expedition will be a joint undertaking of the two organizations named, in cooperation with the National Bureau of Standards, Georgetown Observatory, Naval Research Laboratory, and Yerkes and Lick Observatories. Fifteen scientists, under the leadership of Lyman J. Briggs, chairman of the Research Committee of the National Geographic Society, will be stationed at the base.

The totality of the eclipse will begin at Bocayuva at about 9:55 A.M. and will last for approximately 3 minutes, 50 seconds. At that time the altitude of the sun will be close to 40°. According to the program that has been worked out, the observers will seek to obtain photographs of the corona in black and white and in color, photographs showing the polarization of coronal light, and spectrograms of the flash spectrum and of the corona. Measurements will be made of the variation in brightness of the crescent of the sun as totality is approached, the changes which take place in the ionized layers of the earth's atmosphere, the times at which the moon makes its four so-called "contacts" with the sun's disk, and the apparent displacement of the positions of the stars close to the sun in order to test the Einstein theory of relativity. Studies will be made of the temperature of the corona near the limb of the sun and of the distribution of daylight intensity at various altitudes during the period of the eclipse.

The AAF will transport the most important instruments to the base by air, furnish the all-important time signals needed in the work of the civilian scientists, and maintain observation planes at various altitudes during the eclipse. During the progress of the eclipse AAF meteorologists will send up balloon-lifted radio sondes to gather information in regard to temperature, pressure, and water-vapor content of the air.

Suggestions for improvement of the dissemination of scientific news by Ralph W. Gerard speaking on a panel discussión in Boston, "Science and the Public," included certification of newsmen, more science features than spot news, training in scientific journalism, greater public service from scientific societies, approval or condemnation by official scientific bodies, public reports on scientific matters by boards of scientific consultants for newspapers, radios, and movies, government support of research and subsidy of mass media by government agencies of communication.

"Science, communication media and the public are inextricably bound to each other; they must not merely interact but interact usefully; each must minister to the needs of the others," he said.

The Union International Contre le Cancer has been invited by the Board of Directors of the American Association of Cancer Research to cooperate in holding the Fourth International Cancer Research Congres in September 1947 in St. Louis. E. V. Cowdry, director of research in the Barnard Free Skin and Cancer Hospital and professor of anatomy at Washington University, was appointed president of the Congress, at the Director's meeting held in the Sterling Hall of Medicine, Yale University, on October 13. At a meeting of the Executive Committee of the Union International Contre le Cancer, held in Paris on November 13, this invitation was accepted and Dr. Cowdry's appointment confirmed. Organization of the Congress is well advanced and announcement of committees is expected soon.

C. G. G. J. van Steenis, senior botanist, Department of Economic Affairs, Buitenzorg, Java, arrived in the United States December 16 to discuss with American colleagues his plans for the *Flora Malesiana*, a new flora of the Malaysian Archipelago now being prepared on an international cooperative basis. He is accompanied by Mrs. van Steenis who is completing the first volume of the flora, an extensive historical introduction.

The Committee for Foreign Correspondence of the Federation of American Scientists recently distributed over 10,000 pamphlets to scientists in 60 different nations. The literature, intended to aid nations in understanding problems underlying international atomic energy control, as well as necessity for control, included full texts of United Nations Atomic Energy Commission reports, the State Department's "Report on International Control of Atomic Energy," the booklet, "One World or None," and others.

The Council for Scientific and Industrial Research has established liaison offices in London and Washington. The officer-in-charge of the Washington office is E. P. Phillips, former chief of the Division of Botany and Plant Pathology, Department of Agriculture, Pretoria, South Africa. Scientific research workers and industrial technicians wanting information about their fields in South Africa should write to Dr. Phillips, 1785 Massachusetts Avenue., N. W., Washington 6, D. C.

A geological wall map of North America has been published by The Geological Society of America and is available for distribution. The map, begun in 1940, was compiled by George W. Stose, of the U. S. Geological Survey, from the latest published maps available. The compilation was financed by the Geological Society of America, the American Philosophical Society, and the American Association of Petroleum Geologists, and had the cooperation of the U. S. Geological Survey, the Geological Surveys of Canada and Mexico, state and provincial surveys of the United States and Canada, and individual geologists.

On a scale of 1:5,000,000, the map is printed in two sheets which, when mounted, make a wall map 76 inches high by 55 inches wide. Selection of the map units, their classification and arrangement in the legend, and adoption of the color scheme are by Mr. Stose. The map is printed in 19 geologic colors, 90 units being represented by color patterns. Orders for the map at $3.50 a copy should be sent to The Geological Society of America, 419 West 117 Street, New York 27, Attention: Miss M. Osborne.

A group of 60 U. S. college and university students will go to Sweden within the next few weeks to attend courses at the University of Stockholm. While designed to meet the needs of veterans studying abroad under the G. I. Bill of Rights, the courses are open to other qualified candidates. The first semester's work will be in English and will provide intensive training in the Swedish language and Scandinavian institutions. During the second semester courses will be offered on scientific and technical developments in Sweden, the Swedish language, and social, economic, and political conditions.

The National Geological Survey of China, reports it has returned to its old address, 942 Chukiang Road, Nanking, after 10 years. In 1936, following the Japanese invasion, the Survey set up temporary headquarters at Pehpei, near Cunking. Most work continued without interruption, it was noted; most publications came out despite drawbacks and are ready for exchange with other institutions.

Recent Deaths

Albert Davis Mead, 77, emeritus professor of biology, Brown University, died December 8 in Pasadena, California. He had been a member of the university faculty since 1895 and vice-president from 1926–1936.

Edward Laurens Mark, 99, emeritus professor of anatomy, Harvard, died at his home in Cambridge December 16. Dr. Mark taught at Harvard for 45 years, retiring in 1921 as Hersey professor of anatomy, a post he had held since 1885. He was director of the Harvard Zoological Laboratories from 1900 to 1921 and the Bermuda Laboratory for Research from 1903 to 1931.

Clyde Henderson Campbell, food chemist, died December 12 in St. Petersburg, Florida, where he had been for some time because of ill health. Before his illness he was state chemist for the city of Pittsburgh and later maintained his own food testing laboratory.

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Harvard Medical School, The Boston Lying-in Hospital, and *The Free Hospital for Women, Brookline, Massachusetts*

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Group 3. Seven patients who had recently delivered were tested for absorption after receiving 200,000 units of penicillin. Results were similar to, even slightly better than, those in the nonpregnant patients of Group 1. Four patients, 10 days post partum, had high concentrations in their blood: at ½ hour, levels ranged from .625 to 1.250 units with an average of .938 unit; at 1 hour, from .625 to 1.250 units with an average of .781 unit; and at 4 hours, from 0 to .156 unit with an average of .063 unit. One patient, 9 days post partum, had no concentration at ½ hour and only .019 unit at 1 and 4 hours. Two patients, respectively 14 and 35 days post partum, showed moderate levels ranging from .312 to .039 unit at ½ hour, .312 to .312 unit at 1 hour, and 0 to .039 unit at 4 hours.

Summary. Except during the last two months of pregnancy, penicillin is easily absorbed from cocoa butter suppositories in the vagina, ordinarily to give therapeutic blood levels for from 4 to 6 hours. Penicillin in the dosage used seems to have a good effect on vaginal infections. In nonpregnant women, during the ovulation phase, considered as including days 14 ± 2 in the ordinary menstrual cycle of about 28 days, absorption seemed to be somewhat diminished. Higher levels were found in patients who were near the end of their menstrual cycles and in two patients who were menopausal. Patients who were very near term absorbed little or no penicillin, whereas patients 10 days post partum showed excellent absorption.

[1] Generously supplied by Schenley Laboratories, Inc.

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Investigations concerning the influence of steroid gonadal hormones on carcinogenesis have revealed many significant relationships. On the other hand, much less is known of the action of pituitary hormones on the development of tumors, although such relationships have been studied by injections of different pituitary preparations and by observing the effects of hypophysectomy on tumor-bearing animals or animals given carcinogenic substances (*10*). Recently, Pfeiffer and Hooker (*9*) obtained small local overgrowths of testicular interstitial cells in mice of the A strain that were given daily injections of pregnant mare's serum for several months. These growths resembled early stages in the development of the interstitial cell tumors that have been induced in estrogen-treated mice of this strain. The difficulty of obtaining purified and standardized gonadotropic hormones, and the formation of antihormones, have impeded adequate study of the long-term effects of gonadotropins.

It has been shown that many estrogenic and androgenic hormones are inactivated when circulated through the hepatic portal system (*12*). Furthermore, the intrinsic production of gonadotropins is increased subsequent to castration, as determined by urinary or hypophyseal bio-assays, or in experimental parabiosis of an intact with a castrated animal (*4*). The

[1] This research has been aided by grants from the Anna Fuller Fund and the Jane Coffin Childs Memorial Fund for Medical Research.

C. G. G. J. van Steenis, senior botanist, Department of Economic Affairs, Buitenzorg, Java, arrived in the United States December 16 to discuss with American colleagues his plans for the *Flora Malesiana*, a new flora of the Malaysian Archipelago now being prepared on an international cooperative basis. He is accompanied by Mrs. van Steenis who is completing the first volume of the flora, an extensive historical introduction.

The Committee for Foreign Correspondence of the Federation of American Scientists recently distributed over 10,000 pamphlets to scientists in 60 different nations. The literature, intended to aid nations in understanding problems underlying international atomic energy control, as well as necessity for control, included full texts of United Nations Atomic Energy Commission reports, the State Department's "Report on International Control of Atomic Energy," the booklet, "One World or None," and others.

The Council for Scientific and Industrial Research has established liaison offices in London and Washington. The officer-in-charge of the Washington office is E. P. Phillips, former chief of the Division of Botany and Plant Pathology, Department of Agriculture, Pretoria, South Africa. Scientific research workers and industrial technicians wanting information about their fields in South Africa should write to Dr. Phillips, 1785 Massachusetts Avenue., N. W., Washington 6, D. C.

A geological wall map of North America has been published by The Geological Society of America and is available for distribution. The map, begun in 1940, was compiled by George W. Stose, of the U. S. Geological Survey, from the latest published maps available. The compilation was financed by the Geological Society of America, the American Philosophical Society, and the American Association of Petroleum Geologists, and had the cooperation of the U. S. Geological Survey, the Geological Surveys of Canada and Mexico, state and provincial surveys of the United States and Canada, and individual geologists.

On a scale of 1:5,000,000, the map is printed in two sheets which, when mounted, make a wall map 76 inches high by 55 inches wide. Selection of the map units, their classification and arrangement in the legend, and adoption of the color scheme are by Mr. Stose. The map is printed in 19 geologic colors, 90 units being represented by color patterns. Orders for the map at $3.50 a copy should be sent to The Geological Society of America, 419 West 117 Street, New York 27, Attention: Miss M. Osborne.

A group of 60 U. S. college and university students will go to Sweden within the next few weeks to attend courses at the University of Stockholm. While designed to meet the needs of veterans studying abroad under the G. I. Bill of Rights, the courses are open to other qualified candidates. The first semester's work will be in English and will provide intensive training in the Swedish language and Scandinavian institutions. During the second semester courses will be offered on scientific and technical developments in Sweden, the Swedish language, and social, economic, and political conditions.

The National Geological Survey of China, reports it has returned to its old address, 942 Chukiang Road, Nanking, after 10 years. In 1936, following the Japanese invasion, the Survey set up temporary headquarters at Pehpei, near Cunking. Most work continued without interruption, it was noted; most publications came out despite drawbacks and are ready for exchange with other institutions.

Recent Deaths

Albert Davis Mead, 77, emeritus professor of biology, Brown University, died December 8 in Pasadena, California. He had been a member of the university faculty since 1895 and vice-president from 1926–1936.

Edward Laurens Mark, 99, emeritus professor of anatomy, Harvard, died at his home in Cambridge December 16. Dr. Mark taught at Harvard for 45 years, retiring in 1921 as Hersey professor of anatomy, a post he had held since 1885. He was director of the Harvard Zoological Laboratories from 1900 to 1921 and the Bermuda Laboratory for Research from 1903 to 1931.

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role of the intrinsic gonadotropic hormones of the pituitary gland in tumor formation could thus be studied by the transplantation of gonads into the spleen or other sites drained by the portal vein. Biskind and Biskind (*2*) reported that three ovarian and one testicular tumors developed in gonads transplanted into the spleens of castrated rats, although Lipschütz, *et al.* (*7*) observed only growth of lutein cells in guinea pigs under similar circumstances. This paper is a report of tumors in intrasplenic ovarian transplants in castrated mice.

Inbred mice of the Strong A and C_3H strains[2] and hybrid mice (AC_3, AC_5)[3] were used. Six groups of experiments were set up (Table 1). Castration and grafting were done when the mice were one to three months old, except in the group bearing intratesticular transplants, in which a few mice were operated on at 130 days of age. The donors of the ovaries for the homo-or heterotransplantations were usually younger than the recipients. All experimental animals received no treatment other than that mentioned.

growth observed in a subcutaneously transplanted ovary in a castrated female mouse. The mouse was the only one that was operated on during pregnancy.

Most of the ovarian tumors protruded from the surface of the spleen; the largest measured 5 x 8 x 9 mm. in diameter. The tumors usually had a smooth, reddish-yellow surface, and some showed few scattered hemorrhagic follicles as indicated by dark red spots. On microscopic examination, most of the tumor cells of the granulosa-cell tumors appeared indistinguishable from the granulosa cells of the normal Graafian follicle, and mitoses were frequent. The ovarian tumors usually contained small and medium-sized, somewhat distorted cavities that were sometimes filled with blood cells or a few degenerating cells, and many solid masses or granulosa-like cells. The cells of the latter structures either were arranged in delicate, sinuous, single-celled cords or, in some places, assumed a trabecular appearance. Thus, the granulosa-cell tumors were preponderantly diffuse and folliculoid in pattern, as featured by Barzilai (*1*) in human material. The luteomas were composed

TABLE 1

TUMORS IN OVARIES TRANSPLANTED TO CASTRATED MICE

Site of transplant	Hosts	No. of mice	Tumors*			
			Granulosa cell	Luteoma	Mixed	None
Spleen	Castrated males	21	5 (224–268 days) 2? (130–262 days)	0	1 (225 days)	13 (75–268 days)
Spleen	Castrated females	33	0	4 (153–284 days)	7 (266–346 days)	22 (25–334 days)
Spleen (adhesion)	Castrated females	19	0	1 (262 days)	0	18 (95–346 days)
Subcutaneous	Castrated females	25	1? (243 days)	0	0	24 (61–278 days)
Subcutaneous	Intact males	12	0	0	0	12 (141–239 days)
Subcutaneous	Castrated males	9	0	0	0	9 (64–233 days)
Testis	Intact males	25	0	0	0	25 (32–353 days)

* The age of the transplant is given in parentheses.

Five granulosa-cell tumors, two probable tumors of the same type, and one mixed tumor consisting of both granulosa and luteomatous cells were found among the 21 castrated male mice with intrasplenic ovarian transplants. Four luteomas and seven mixed tumors were found among the 33 castrated female mice that showed no adhesion of the intrasplenic ovarian graft to the left uterine horn or to the adjacent peritoneum. Among the 19 castrated female mice with vascularized adhesions of the ovarian transplant, one luteoma was observed in a mouse that had irregular estrous cycles during the latter part of the experimental period. Mice of the A strain were used in these two groups of experiments, and most of the ovarian tumors developed in castrated mice carrying the intrasplenic ovarian transplants for more than seven months. No ovarian tumors were found in other sites of transplantation except for one small granulosa cell tumor-like of lutein-like cells arranged to form numerous small, tubular or cord-like structures, each surrounded by a delicate connective tissue septum. Sinusoidal blood capillaries and pigment containing cells were observed frequently among the luteinized tumor cells in some areas. Mitoses of the luteomatous cells were rare. In the mixed tumors there were transitional areas between the granulosa-cell and luteomatous types of tumor cells, which indicated that the luteomas were derived from luteinization of the granulosa cells of the tumors. In general, the histological features of the ovarian tumors were similar to those described by previous workers in the ovaries of X-rayed mice (*3, 5, 6, 11*).

The prostates and seminal vesicles of the castrated male mice with intrasplenic ovarian transplants were atrophic. Only three castrated female mice having tumors of the intrasplenic ovarian transplants showed estrous vaginal smears, two early and one in the later part of the experiment. No estrous smears were obtained from the other eight ovariectomized mice that had tumors in the intrasplenic ovarian transplants; their uteri were small, averaging about 37 mg. A de-

[2] These mice were supplied by Dr. L. C. Strong.

[3] AC_3 are first-generation hybrid mice of the following parentage: C_3H (low-tumor) ♀ X A ♂. AC_5 are first-generation hybrid mice of the parentage: A (low-tumor) ♀ X C_3H ♂.

tailed description of the histological findings, together with the physiological effects, of the ovarian grafts and ovarian tumors induced in the present experiments will be reported elsewhere.

It is of especial interest that the pure granulosa-cell tumors and luteomas developed only in the castrated male and female mice, respectively, bearing the intrasplenic ovarian transplants. This may be due to structural and physiological differences in the pituitaries of male and female mice similar to those observed in rats (*8*).

Experimental induction of ovarian tumors in mice following X-ray irradiation has been reported previously (*5*, *6*, *11*), although no explanation as to the cause of the neoplastic formations was given. Because the histological structure of granulosa-cell tumors and the luteomas appearing in the ovaries transplanted into the spleen were similar, if not identical, to the ovarian tumors induced with roentgen rays, it seems that the same mechanism, namely, gonadotropic overaction, might be responsible for the tumors under both circumstances.

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Human Amino Acid Requirements

Robert A. Harte and John J. Travers

Research Laboratories, The Arlington Chemical Company, Yonkers, New York

A recent report (*2*) from Mitchell's laboratory presented data from which were calculated the requirements of normal young adult female humans for nitrogen balance for three different proteins: milk, soy flour, and white flour. From these figures and the analytical data summarized by Block and Bolling (*1*) it is possible to follow the pattern of estimation described by Stare, *et al.* (*3*) for egg protein, and calculate some of the individual amino acid requirements for humans on these bases.

For convenience of comparison, Mitchell's protein requirement figures for nitrogen balance, based on a 59.55-kg. female subject consuming a total of 1,300 calories, were extrapolated linearly to 70-kg. subjects. The corresponding data of Stare's estimate, which so far lacks experimental verification, are included in Table 1, while the calculated results for the individual amino acids are given in Table 2.

Theoretically, such calculations should have validity only if the biologic value of the protein is essentially unity. The fact that agreement is quite good, despite the wide range of biologic values reported by Mitchell (0.41–0.74), suggests that biologic value may be determined largely by the "essential" amino acid content, and the fraction of absorbed nitrogen excreted in the urine (which reduces the biologic value from unity) may merely reflect the excess of "nonessential" amino acids which cannot be utilized for lack of the necessary quantity of "essentials."

TABLE 1

Human Protein Requirements for Nitrogen Balance

Protein	Grams required for equilibrium in females (59.55 kg.) on 1,300-cal. diets (N × 6.25)	Coefficient of true digestibility	Grams protein corrected for digestibility* for 70-kg. individual (N × 6.25)
Milk†	22.4	0.94	24.7
Soy flour†	23.4	0.92	25.3
White flour†	38.7	0.97	44.1
Egg‡	—	1.00	28.0

* For the purpose of these estimates it is assumed that the effect of digestibility is the same on all amino acids. Since the digestibility figures are close to unity, the error thereby introduced is not likely to be greater than the various experimental errors in the analytical data, etc.

† Mitchell's data.

‡ Stare's estimate.

TABLE 2

Human Amino Acid Requirements for Nitrogen Balance
(Grams/day)

	Protein source				Minimal quantity
	Milk	Soy flour	White flour	Egg	
Arginine	1.2	1.5	1.7	1.8	1.2
Cystine	0.8	0.2	0.8	0.5	0.2
Histidine	0.7	0.6	1.0	0.5	0.5
Isoleucine	1.3	1.2	1.6	1.3	1.2
Leucine	3.0	1.7	5.3	3.6	1.7
Lysine	1.8	1.4	0.8	1.4	0.8
Methionine	0.5	0.5	1.3	1.4	0.5
Phenylalanine	1.5	1.4	2.4	1.4	1.4
Threonine	1.1	1.0	1.2	1.2	1.0
Tryptophane	0.5	0.4	0.4	0.4	0.4
Tyrosine	1.3	1.0	1.7	1.0	1.0
Valine	1.4	1.1	1.5	1.3	1.1

Of particular interest is the relatively good agreement of these several estimates. Most striking, perhaps, are the relatively low quantities of cystine and methionine in the case of soy flour and of lysine in the case of white flour. Bearing in mind the well-known observation that lysine seems to be the limiting amino acid in the utilization of white flour by the growing rat, it is not surprising that more of that protein is required for balance than either milk or soy flour. Table 2 also reflects this state of affairs by offering, in every other case except tryptophane, substantially more of the individual amino acids

at balance level for white flour than for the other proteins studied. It would appear, then, that the lysine and tryptophane contents of white flour are perhaps limiting factors in human protein metabolism also.

The values recorded here must be regarded as purely approximate because of the lack of rigorous definition of the proteins studied and also because of the uncertainties associated with the analytical figures used for the calculations, as well as the effects of digestibility coefficients and biologic values more or less removed from unity. The effect of considering these figures in the light of protein requirements for what Mitchell calls true maintenance and "adult growth" has yet to be determined. Nevertheless, they may serve as useful approximations for interim purposes. The last column of Table 2 lists the minimal quantities of each amino acid so far adduced as required for maintenance of human nitrogen balance.

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Sex Produced in the Protozoa of *Cryptocercus* by Molting

L. R. Cleveland

Department of Biology, Harvard University[1]

Twenty-five species of flagellate protozoa live in the hind gut of the wood-feeding roach, *Cryptocercus punctulatus* (*1*). They represent a varied assortment of organisms, ranging from small, fairly simple cells to large, complex ones, and comprise 2 orders, 8 families, and 12 genera. They all exhibit some form of sexual behavior when their host molts, but between molts there is no sexual behavior, they have the haploid number of chromosomes, and division is mitotic. However, under the influence of molting, their chromosome number is doubled, and they remain diploids until two meiotic divisions convert them again to haploids. But this reversible process of mitosis to meiosis does not occur in all of them at the same time: some begin it in the early stages of molting, finishing two or three days before the exoskeleton is shed; others do not begin it until 10–15 hours after the exoskeleton is shed and do not complete it until two to three days later. Also, they do not all employ the same method in changing from haploidy to diploidy.

The sexual process is fertilization in *Trichonympha*, *Leptospironympha*, and *Eucomonympha*, but in each genus there are interesting fundamental differences in the details of the process. In *Trichonympha* gametogenesis occurs within cysts, each gametocyst producing two gametes. In *Eucomonympha*, no cysts have been seen, and the method by which the gametes are formed is unknown. In *Saccinobaculus*, *Barbulanympha*, etc., other processes occur.

In *Trichonympha*, both gametes are the same size, but there are very definite, easily recognized differences between them before fertilization begins; and sometimes these differences may be seen before excystation, although they are usually not evident until later. The female or egg has an area of clearly defined, large, dense granules embedded in a jelly-like matrix. This area lies in the posterior end of the body and occupies about one-tenth of the entire cell. There is a clear, open space in the center of the area into which the male or sperm, which has no area of specialized granules, inserts its somewhat pointed, anterior, rostral end when fertilization begins. In a comparatively short time very firm contact is made between the gametes, and from this point on the egg plays the active role by ingesting the entire cytoplasmic and nuclear contents of the sperm. Soon after ingestion is complete, the extranuclear organelles of the sperm begin to disintegrate. First the nuclear sleeve, the outer and inner caps, and the postrostral flagella go, then the rostral flagella and the parabasals, leaving only the rostral tube, the rostral lamella, and the two centrioles (a long one and a short one at interphase). In the meantime the sperm nucleus becomes free to move, because of the disintegration of the extranuclear organelles holding it in position. It moves toward the egg nucleus, which is not free to migrate because those organelles which keep it in place, like the others of the egg, do not disintegrate. The membranes of the two nuclei touch each other and soon join so firmly that it is impossible, in living material, to separate one from the other without destroying both nuclei. Their chromosomes, which can be seen clearly in the living state, come closer and closer together, and an attraction between homologues is plainly evident. Complete nuclear fusion results, and the two groups of chromosomes become one group, all lying in a common, enlarged nuclear membrane. By this time, or shortly thereafter, the remaining extranuclear organelles of the sperm (rostral tube, rostral lamella, and centrioles) begin to disintegrate and soon disappear. Now a duplication of the male and female chromosomes occurs, and they enter the first meiotic prophase. As they shorten, synapsis and tetrad formation occur. At this point, the centrioles of the egg produce an achromatic figure which functions to separate the shortened, rod-shaped, metaphase chromosomes into two groups, the chromosomes going to the poles as dyads. This is the first meiotic division, and the second, which follows quickly—before the chromosomes have time to divide—is as typical as the first. This returns the chromosomes to the haploid condition.

In *Leptospironympha*, no cytoplasmic differentiation in the gametes has been seen, but their nuclei are clearly differentiated into male and female. As in *Trichonympha*, one gamete begins to enter the other, is ingested, and loses its extranuclear organelles. Nuclear fusion and zygotic meiosis are as in *Trichonympha*. However, *Leptospironympha* differs markedly from *Trichonympha*, in that its gametes are quite unlike the ordinary (somatic?) cells from which they arise. They have only the short rostral portion of flagellar bands. The two long spiral portions, which in nongametic cells extend from the anterior to the posterior end, are absent. The lack of these heavy, rather rigid bands obviously greatly facilitates the entrance of the sperm and the cytoplasmic union of the two cells.

In *Eucomonympha* one gamete does not enter the other; the two join in a manner similar to conjugation in ciliates, although the process is not conjugation in any sense of the word. When the gametes first come together, only a small portion of their

[1] Some of this work was done at the Mountain Lake Biological Station of the University of Virginia. It was aided by a grant from the Penrose Fund of the American Philosophical Society.

surfaces is joined, and they present a picture like that of very late cleavage; later, after joining more completely, they present a picture closely resembling early cleavage. Finally, the furrow between their joined surfaces disappears, and what was once two separate cells now looks exactly like a larger but single cell except for the presence of two nuclei and two rostra. In the early stages of cytoplasmic fusion, the rostra, each with a nucleus held in a fixed position at its base, point more or less in the same direction; however, as fusion progresses, the rostra move in opposite directions, finally taking up positions at opposite ends of the zygote. If the situation is examined more closely, it will be seen that the male gamete which, like the female, has flagella over its entire body except for a very small area at the posterior end, began to lose its flagella about the time the furrow between the fusing gametes disappeared. This process continues until the axostyles and all the flagella with the exception of those on the small, anterior, rostral portion of the body disappear. At this time, or slightly earlier in some instances, the nucleus of the male gamete becomes free of its fixed position at the base of the rostrum and begins to migrate toward the nucleus of the female gamete, which, since *Eucomonympha* is a very large cell, may lie 200–300 μ away. However great the distance may be, the male nucleus succeeds in making contact with the female nucleus, which never moves from its fixed position at the base of the rostrum of the female gamete. By the time the nuclei begin to fuse, or thereabouts, the rostrum, lamella, and centrioles of the male gamete are extruded from the cell, pinched off with the loss of practically no cytoplasm. As in *Trichonympha*, the female gamete never loses any of its organelles, while the male loses all except the nucleus.

In the large polymastigote *Saccinobaculus*, the process is autogamy and begins by simultaneous division of many of the nuclei. The daughter nuclei may move a considerable distance apart in the cell and return to the interphase condition, yet the cytoplasm makes no effort to divide. When the nucleus divides, the flagella and the very large, broad, heavily staining axostyle are discarded and renewed, one new set being produced for each nucleus. This occurs three to five days before the roach sheds its exoskeleton, and the cells remain in this condition for one to two days. Then the posterior ends of the axostyles begin to move together. This process continues until the axostyles lie side by side, from end to end, so closely that one has to look carefully to see that two are present. Since the nuclei are securely anchored to the axostyles near their anterior ends, this brings them close together, and fusion follows, but not immediately. It usually occurs shortly before the roach sheds its exoskeleton, or about two days after daughter nuclei and axostyles come together. It should be noted that *Saccinobaculus*, unlike the three genera already considered, does not lose its extranuclear organelles when the nuclei fuse, but at a considerably later time. The duplication of chromosomes occurs 10–20 hours after nuclear fusion. This is followed by synapsis, formation of tetrads, first and second meiotic divisions. Since the extranuclear organelles do not begin the process of disintegration until the prophase of the first meiotic division, and a long time is required for the large, heavily staining axostyle to be dissolved, the presence of two of these structures, instead of one as in all other divisions, serves as a perfect label for the first meiotic division.

Since the processes occurring in *Barbulanympha* and related genera supply valuable information on the origin and evolution of meiosis, these will be dealt with in another paper.

The writer does not know whether the effect of the molting fluid of the roach on the protozoa is direct or indirect, although the experiments carried out so far suggest that it is direct. Withholding of food, addition of CO_2, and removal of some O_2, conditions present at molting, fail to produce any of these sexual phenomena. However, irrespective of whether the effect is direct or indirect, the results set forth here indicate that the evolution of sexual and asexual phases in the life cycles of protozoa began as an environmental response.

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Hexosediphosphoric Acid in Living Yeast

Heikki Suomalainen and Evi Arhimo

Alcohol Research Laboratory, Helsinki, Finland

Some years ago, Deuticke and Hollmann (*1*) made the sensational report that they had been unable to find hexosediphosphoric acid in the intact muscle. The role of hexosediphosphate as an intermediate in the normal glycolysis was thus again made questionable, and by workers of great authority. Almost simultaneously Macfarlane (*3*), however, showed hexosediphosphate in the living brewer's yeast, where its amount increases during fermentation—a result which Rapoport (*5*) had been unable to obtain two years earlier. Considering the fundamental role of hexosediphosphoric acid in the Embden-Meyerhof-Parnas scheme, it was deemed necessary to reinvestigate the problem, especially as it has been continuously under discussion (*4*). We have therefore made some determinations on baker's and brewer's yeast according to Young's principle as adapted by Deuticke and Hollmann (*1*). According to our control tests, glucose-1-phosphate does not interfere.

TABLE 1

	Hexosediphosphoric acid Total P content γ/1 gram dry weight	
	Fresh yeast	Fermented 15 min. at + 20° C.
Baker's yeast	12	124–125
Brewer's yeast	5–8	49– 86

To 700 (1,000) ml. fermenting solution, including about 0.5 kg. baker's (brewer's) yeast and 35 (50) grams glucose, 150 (210) ml. ice-cold 50 per cent trichloroacetic acid were added in order to stop fermentation. After standing 20 minutes in ice water, the solution was centrifuged. The liquid was freed from nucleotides according to Kerr (*2*) by precipitation with mercuric acetate. The hexosediphosphoric acid was then separated, according to Macfarlane (*3*), as the acid barium salt at pH 3.6 by an addition of 3 vols. alcohol. This was repeated after the removal of inorganic phosphate by magnesium mixture, whereupon it was reprecipitated at pH 8.2, adding .1 vol. alcohol. Determinations on resting yeast were made in the same manner, only without sugar.

The results are compiled in Table 1.

When hexosediphosphoric acid was precipitated only twice, for the first time as the acid barium salt at pH 3.8 and a second time as the neutral salt at pH 8.2, and when removal of inorganic phosphate was omitted, the results were as indicated in Table 2. These values may also more truthfully describe the quantitative proportions of hexosediphosphoric acid in both yeasts.

TABLE 2

	Hexosediphosphoric acid Total P content γ/1 gram dry weight	
	Fresh yeast	Fermented 15 min. at + 20° C.
Baker's yeast	62	214
Brewer's yeast	57	568

Yeasts employed contained few dead cells, the baker's yeast less than 0.5, per cent and the brewer's yeast 1.8–2.6 per cent.

Hexosediphosphoric acid must accordingly be considered as a normal intermediate in the fermentation of sugar both by baker's and brewer's yeast, even in an undestroyed fermentation system.

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Inactivation of Penicillins G and K by Liver and Kidney

Jay Tepperman, N. Rakieten, G. Valley, and Edna W. Lyon

Department of Pharmacology, Syracuse College of Medicine, and Bristol Laboratories, Inc., Syracuse, New York

It has been shown (*1*, *2*) that penicillin K disappears more rapidly from the blood of rabbits and men than do penicillins G, F, and X in comparable dosage. It has also been stated (*1*) that the recovery of penicillin K in the urine of rabbits and men was 30–35 per cent as compared with an average recovery for G, F, and X of 74 per cent in rabbits and 91 per cent in men. In agreement with these data, the curative dose for experimental rabbit syphilis has been found to be very much greater for penicillin K than for the other penicillins (*1*). Eagle and Musselman have ascribed the rapid disappearance of penicillin K from rabbit blood and its comparatively low recovery in the urine to its inactivation by a "relatively thermolabile, nondialyzable constituent of plasma." The following experiments were undertaken in an effort to discover whether or not the liver plays a role in the inactivation of penicillin K.

Crystalline penicillins K and G were used in these experiments.[1] These compounds were characterized by carbon, hydrogen, and nitrogen analyses and by determination of the subtilis-staphylococcus ratios. The assays for penicillin were made by a modification of the Rammelkamp method (*5*). In some of the *in vivo* studies and in the *in vitro* experiments intermediate dilutions were made to detect small differences in penicillin concentration.

Rabbits anesthetized with sodium pentobarbital were used in the first phase of this study. Initially the rate of disappearance from the blood of penicillin K as compared with penicillin G was determined in renal-ligated preparations. In harmony with previously published reports (*1*, *2*), penicillin K was found to disappear from the circulating blood far more rapidly than penicillin G (Table 1).

TABLE 1

Penicillin Levels in Blood of Rabbits Two Hours After the Intravenous Administration of 1,000 O.U./Kg. of Penicillin G or K

Penicillin G O.U./ml. of blood		Penicillin K O.U./ml. of blood	
Eviscerate, renal-ligated	Renal-ligated	Eviscerate, renal-ligated	Renal-ligated
7.5*	5.0	2.50	0.312
7.5*	2.5	2.50	0.156
5.0	5.0	2.50	0.156
5.0	2.5	1.25	0.156
2.5		1.87*	0.156
2.5			
2.5			
Mean 4.64	3.75	2.12	0.187
S.E. ±0.84	S.E. ±0.72	S.E. ±0.25	S.E. ±0.031

* Obtained by modifying the Rammelkamp method to include intermediate values in the usual geometric progression of serial dilution.

The disappearance rates of penicillins G and K were then compared in renal-ligated, eviscerated preparations. The dose of penicillin was 1,000 O.U./kg. of intact body weight as in the first experiment. The results, as shown in Table 1, suggest that the evisceration procedure slowed the inactivation of penicillin K considerably, although the rate of disappearance of penicillin K in the renal-ligated, eviscerated preparations may have been more rapid than the rate of disappearance of penicillin G under the same circumstances. In this connection it should be noted that in the eviscerate preparation used in this study the liver was allowed to remain in the animal with patent hepatic veins, and therefore the animals may have retained some residual liver function (*4*). This interpretation of the data is strengthened by studies of surviving liver slices under anaerobic conditions, to be reported below.

Experiments were undertaken to test the ability of surviving rabbit liver slices to inactivate penicillins K and G *in vitro*. In each experiment approximately 100 mg. wet weight of liver slice were suspended in 3 ml. of Krebs and Henseleit (*3*) phosphate buffer (pH 7.4) containing 0.5 O.U./ml. of either penicillin K or G and 200 mg. per cent of fructose. The Q_{O_2} of the tissue was determined by the direct method. The flasks were filled with oxygen, incubated at 37.8° C., and shaken for 90 minutes at a rate of 120 per minute in a Barcroft-Warburg apparatus. A comparison of the inactivation of penicillin K with that of penicillin G under the same circumstances (Table 2) reveals that the total change in 90 minutes in penicillin K/100 mg. of liver tissue was 0.713 O.U., whereas the corresponding mean figure for penicillin G was 0.18 O.U.

Subsequent experiments showed that 1.05 O.U. of penicillin

[1] The pure penicillin fractions were kindly supplied to us by Dr. W. C. Risser, Bristol Laboratories, Inc.

K was inactivated in the presence of 100 mg. of kidney tissue aerobically. Smaller but appreciable amounts of penicillin G apparently disappeared from the buffered solution in the presence of surviving kidney slices. Further studies revealed that the inactivation of penicillin K by liver and kidney slices occurs in an atmosphere of nitrogen as well as aerobically. The oxygen uptake by the tissue slices suspended in penicillin K-containing buffer was exactly the same as that observed in the case of the slices in penicillin G buffer.

TABLE 2

DISAPPEARANCE* OF PENICILLINS G AND K FROM MEDIUM IN THE PRESENCE OF SURVIVING LIVER AND KIDNEY SLICES

Tissue	Liver			Kidney		
Gas	O_2		N_2	O_2		N_2
Penicillin	K	G	K	K	G	K
	0.60	0.27	0.60	1.05	0.60	0.75
	0.75	0.27	0.60	1.05	0.60	0.75
	0.75	0.27	0.60	1.05	0.60	0.75
	0.60	0.27	0.93	1.05	0.27	0.51
	0.60	0.0	0.93	1.05	0.27	0.51
	0.60	0.0	0.93	1.05	0.27	0.75
	1.02		0.75			
	0.75		0.75			
	0.75		0.90			
Mean	0.713	0.18	0.77	1.05	0.433	0.67

* Disappearance is calculated as O.U./100 mg. of wet weight of tissue. Triplicate analyses on individual rabbits are grouped.

Additional studies are now in progress to determine whether penicillin K is inactivated by other tissues, and whether intact liver and kidney cellular structure is essential for the effect noted above.

Summary. The inactivation of penicillin K is more rapid in the renal-ligated rabbit than in the renal-ligated, eviscerate preparation. Inactivation of penicillin K occurs in the presence of surviving liver and kidney slices. Small amounts of penicillin G were inactivated by liver slices; larger amounts disappeared in the presence of kidney slices. The inactivation of penicillin K in the presence of rabbit liver and kidney slices is demonstrable anaerobically as well as aerobically.

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IN THE LABORATORY

Measurements of Underwater Noise Produced by Marine Life[1]

M. B. DOBRIN

Naval Ordnance Laboratory, Washington, D. C.

That certain fish species make noise under water has been common knowledge among fishermen since ancient times. For at least a century, observations on this phenomenon have been published by naturalists and zoologists. Until recently, however, all observations upon noise produced in this way were incidental and qualitative. No physical measurements of its frequency distribution or intensity are reported anywhere in the biological literature. It was not until the recent war that a need was felt for exact quantitative data on biological water noise. The introduction during the war of underwater acoustic equipment, such as listening devices, submarine detecting gear, acoustic mine mechanisms, and homing torpedoes, raised questions as to the interference that might be expected from natural background noises in the water. For this reason, information was required on the nature and magnitude of the water noise to be expected at various localities and under various conditions. Since no data of the type needed were available in the general literature, it was necessary for war research agencies working in underwater sound to make their own measurements. A large body of data was accumulated in this way which should considerably augment previously available knowledge of natural water noise and its production.

Although waves, wind, and tidal currents give rise to a measurable amount of water noise, this is seldom of a higher order of magnitude than 1 dyne/cm. 2 in an octave band and is usually much lower. Biological sources, on the other hand, can be responsible for sustained noises with an octave pressure of several hundred dynes per square centimeter.

MEASUREMENT OF NATURAL WATER NOISE

The Naval Ordnance Laboratory carried on background measurements at several field locations where biological noises were particularly intense, and it has recorded the highest natural water-noise levels that have been observed anywhere. At the same time, a systematic effort was made to identify the species giving rise to the different kinds of fish noises recorded. This involved elaborate tests on segregated fish species, both in aquaria and in experimental ponds.

[1] The field measurements and data reductions upon which this report is based were carried on by the following staff members of the Naval Ordnance Laboratory: L. G. Swart, G. E. Brown, L. C. Bell, D. L. Bobroff, R. F. Grunwald, G. R. Irish, W. E. Loomis, and the author. The consulting biologist for much of the work was Cdr. Charles J. Fish, USNR, of the Mine Warfare Operational Research Group. Walter H. Chute, director of the John G. Shedd Aquarium, gave the Laboratory substantial cooperation in its measurements there, and H. F. Prytherch, director of the U. S. Fishery Biological Laboratory, Beaufort, North Carolina, generously granted use of facilities for the field measurements and segregation tests reported from that area.

Procedure. Underwater background noises were picked up at all locations by underwater hydrophones and recorded on discs which were later played through an octave analyzer into a series of Esterline-Angus tape recorders, each octave over the range 50–3,200 c.p.s. being recorded on a separate tape. Calibration was by 1-kc. signal corresponding to a known sound pressure injected into the hydrophone circuit. Spectra were calculated and plotted from the octave tapes. At the same time, the disc recordings were available for listening and identification.

The hydrophones were of the Brush C-21 rubber-covered crystal type or the RCA 2A condenser type with a Monel diaphragm. Each kind had preamplifier inside the case. Discs were made with RCA cutting heads operated through standard Brush or RCA recording amplifiers. Filters in the analyzing system were of the ERPI octave type. The recording system is designed to give mean rectified sound pressure instead of root mean square or peak pressure. For the case of impulsive noises, such as the drumming and grinding produced by fish, the peak noise would be some 40 per cent higher than the mean rectified signal.

Direct Field Data

Disc recordings of underwater background noise in open water have been made by the Naval Ordnance Laboratory at various points along the East Coast of the United States from Florida to Cape May. During the course of these surveys, biological noise of many kinds has been heard and recorded. The measurements have been under a wide variety of circumstances as regards oceanographic conditions, season, time of day, etc.

Frequency Spectra. The large variation that can be expected in the background at a single location is illustrated in Fig. 1 by spectra obtained at typical locations along the East Coast. The ordinates represent the sound pressure observed within an octave band. These are plotted at the mid-band frequency of the octaves extending from 50 to 3,200 c.p.s., the points being connected by smooth curves. The two highest curves were recorded at Wolf Trap, in the middle of Chesapeake Bay, where the water depth is 40 feet. The spectra were both recorded in early July, but in successive years. The frequency characteristics are almost identical, although the 1942 level is about 60 per cent higher than the 1943. The frequency at which the peak noise level occurs is here observed at about 350 c.p.s. This is more than an octave lower than the peak recorded at Cape Henry in 1942, about five weeks earlier, which is the third highest curve in Fig. 1. The difference is probably attributable to the time interval between the two measurements rather than to their geographical separation. Since the source of noise in all cases was almost certainly croakers or other members of the Sciaenidae family, the fish would have grown longer during the intervening period and thus would produce resonant vibrations having lower pitch.

Of the other two curves, one was recorded in June 1943 at Fort Macon, North Carolina. The peak occurs at about 600 c.p.s., and the source is very likely to be croakers. The other was recorded from a boat in the open Atlantic, approximately 20 miles off shore, south of Cape Lookout, North Carolina. The noise here, although of the same character as that of croakers, is of much higher pitch than any Sciaenidae noise recorded elsewhere, the peak occurring at about 2,400 c.p.s. A search of the literature revealed that the bastard trout (*Cynoscion nothus*) is common off shore in this area but has not been observed near shore. This species, attaining a minimum length of 3 inches, is smaller than other drumfish along the United States east coast, and would thus be expected to produce a noise of higher pitch.

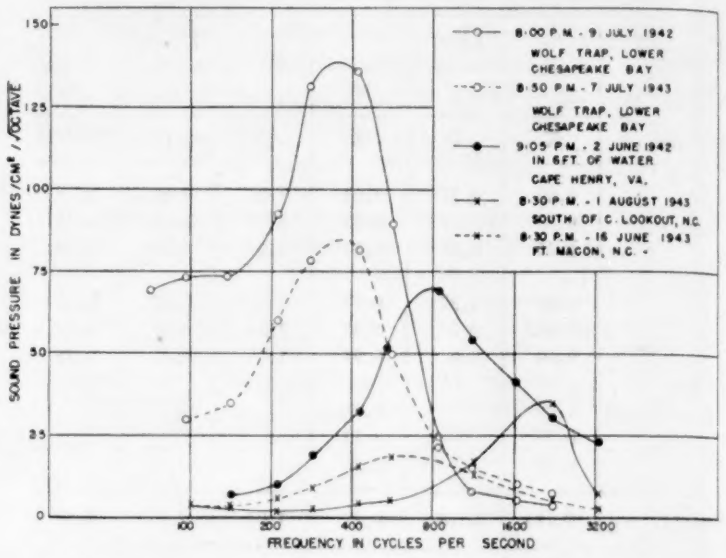
SOUND PRESSURE IN DYNES/CM² / OCTAVE
FREQUENCY IN CYCLES PER SECOND
8:00 P.M. - 9 JULY 1942
WOLF TRAP, LOWER CHESAPEAKE BAY
8:50 P.M. - 7 JULY 1943
WOLF TRAP, LOWER CHESAPEAKE BAY
9:05 P.M. - 2 JUNE 1942
IN 6FT. OF WATER
CAPE HENRY, VA.
8:30 P.M. - 1 AUGUST 1943
SOUTH OF C. LOOKOUT, N.C.
8:30 P.M. - 16 JUNE 1943
FT. MACON, N.C.

FIG. 1. Spectra of water noise caused by marine life at various points along the East Coast of the United States.

Seasonal variation. Distinct seasonal effects were observed in the water noise recorded in Chesapeake Bay. This variation was associated with seasonal movement of the croakers in the Bay. The daily maximum nocturnal noise levels at Cape Henry are plotted in Fig. 2 over the period from the middle of

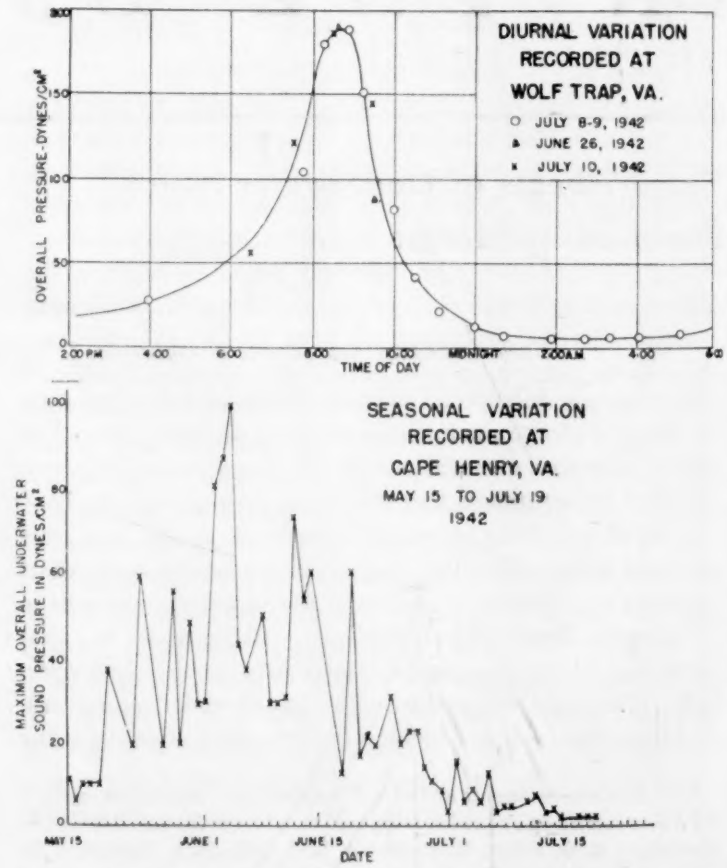

FIG. 2. Diurnal variation of water noise produced by marine life at Wolf Trap, Virginia, and seasonal variation of maximum daily water noise at Cape Henry, Virginia.

May to the middle of July. The peak of activity was during the early part of June, and by July 15 the activity was virtually over.

Diurnal effects. Diurnal variation in background noise level at Wolf Trap is also plotted in Fig. 2. The plot represents the composite of observations taken on three different days during the summer of 1942. Here the peak was reached at about 8:30 P.M., the curve being almost symmetrical around that time. At Beaufort and Fort Macon, North Carolina, the following year, the peak during June was reached at approximately 12:30 A.M. each night. The reason for this well-defined recurrent nocturnal appearance of the noise is not known definitely, although it is suspected that the peak coincides with feeding activity on the bottom.

Studies of Segregated Fish

Noises made by known fish species have been recorded and measured both at the Shedd Aquarium in Chicago and at the U. S. Fishery Biological Laboratory, Beaufort, North Carolina. The purpose of the tests in the aquarium was to determine which of the species in the collection was sonic, the conditions under which the sonic species could be induced to make noise, and the general nature of their noise. Although the noises were recorded on discs, it was not possible to measure absolute sound pressures or to make accurate frequency analyses. Most of the fish that produced noise in the aquarium belonged to families previously reported to be sonic in the biological literature. There were several species, however, for which no record of sound production could be found in the literature which turned out to be prolific noisemakers. Several members of the Pomacentridae family, such as the *Hypsypops rubicundus*, or garibaldi, of Southern California and the *Eupomacentrus fuscus*, or coral-reef fish, were among these, as were certain species of catfish.

At Beaufort, conditions of segregation were much more favorable for accurate quantitative measurement of fish noise. Species were put into separate enclosures set off by chicken-wire fence in a 75 x 85 foot experimental salt-water pond about 3 feet in depth, with a mud bottom. Hydrophones were planted in each enclosure. Fish were caught by commercial fishermen, who transported them to the experimental pond in a live car. The number of specimens investigated ranged from several hundred in the case of croakers to three in the case of sea robins. Results of the tests will be discussed briefly here. Fig. 3 shows the frequency characteristics of the various sonic species.

Croaker (*Micropogon undulatus*): The most common drumfish in the estuarine waters of the U. S. East Coast is the croaker, and this is believed to be responsible for the greatest part of the noise observed in the open-water tests previously discussed. Its noise consists of rapid drum rolls resembling the sound of an electric drill being driven into asphalt. This sound is made by the action of special "drumming muscles" against the fish's air bladder, which is set into resonant vibration at a frequency that should be inversely proportional to its length. In captivity, inside a wire-net enclosure, croakers made noise spontaneously but with noticeably less vigor and intensity than when observed under entirely natural conditions. The noise came in bursts consisting usually of only two or three drum beats of lowered pitch instead of the rapid, vibrant trill heard in open water. Noises were audible under water as much as 25 feet from the source, as was evinced by moving the hydrophone away from the croaker enclosure until the characteristic noise could no longer be distinguished.

Toadfish (*Opsanus tau*): Most remarkable of all fish studied in the current survey was the toadfish. A sluggish, ill-tempered, nest-building bottom dweller, this genus produces a much more intense noise than any other form of marine life investigated. The sound is an intermittent, low-pitched musical blast of about ½-second duration, somewhat similar to a boat whistle, and is concentrated at the low-frequency end of the spectrum, as shown in the typical curve of Fig. 3, which represents the noise emitted by a toadfish within a few inches of the hydrophone.

Unfortunately, the identification of this noise must be based on circumstantial rather than direct evidence. A direct identification was never possible, because no toadfish specimen would make noise in captivity. Hence, instead of following the usual procedure of capturing a specimen and inducing it to make noise, one first located the suspected noise in open water and tracked down its source. This was not difficult, because the characteristic musical sound was heard almost constantly, at least in the distance, wherever a hydrophone was lowered into the water. On moving the hydrophone toward the source of noise until maximum intensity was recorded, it was found that the source remained at one spot on the bottom for days at a time. This fact definitely suggested the toadfish as source, since it is the only sluggish species in this area.

To obtain direct proof, diving was tried but failed because of poor visibility. A baited crab trap was then lowered into the water at the point where the hydrophone indicated maximum noise. Shortly thereafter the blasts stopped for the first time in over a week; and when the trap was pulled up, it contained a toadfish.

Hogfish (*Orthopristis chrysopterus*): A close relative of the grunt, a common tropical offshore fish, the hogfish gets its name from the characteristic grunting noise it makes when taken from the water. This noise is produced by gnashing of the pharyngeal teeth and has a harsh, rasping quality. Under water the noise is made spontaneously in bursts of four or five rasps following each other in rapid succession.

The hogfish is common in the waters surrounding Beaufort, but its noise was heard only occasionally from the Fishery Laboratory Pier on Piver's Island or at Fort Macon. It was concluded on the basis both of tests at Beaufort and of previous aquarium studies that those fish making noise by gnashing of the pharyngeal teeth are not as important sources of underwater noise as those producing sound by action of the air bladder, viz., croakers and toadfish.

Spot (*Leiostomus xanthurus*): The spot, as a member of the Sciaenidae family, is closely related to the croaker, but its noise is of quite a different timbre. The sound might best be described as a series of raucous honks, having a volume level and frequency distribution typified in Fig. 3. Moving the hydrophone away from the enclosure containing the spot indicated that the noise was audible no more than 5 feet from its source, and hence is initially not as intense as that of the croaker.

Spot were heard occasionally around Piver's Island and in offshore waters around Cape Lookout, but the magnitude and character of the noise are such that it is not believed to be a significant contribution to the over-all background level in open water. Moreover, spot are reported to be solitary rather

than gregarious, and hence sources of this noise would probably be dispersed.

Sea robin (*Prionotus carolinus*): The segregation tests on sea robins were not very satisfactory because specimens were seldom available, and the only recordings of their sounds were made in aquarium tanks rather than in the experimental enclosures. The noise of this species is so characteristic, however, that the aquarium tests made its identification in natural waters quite simple.

levels due to sea robins alone, since they were always heard simultaneously with croakers and other sonic species.

The mechanism of sound production in the sea robin is, according to Tower (*1*), the same as that of the toadfish. The considerable difference between the noises, however, both in character and intensity, casts doubt upon the correctness of this observation.

Sea catfish (*Felichthys felis*): During the course of the segregation tests it was found rather unexpectedly that the common

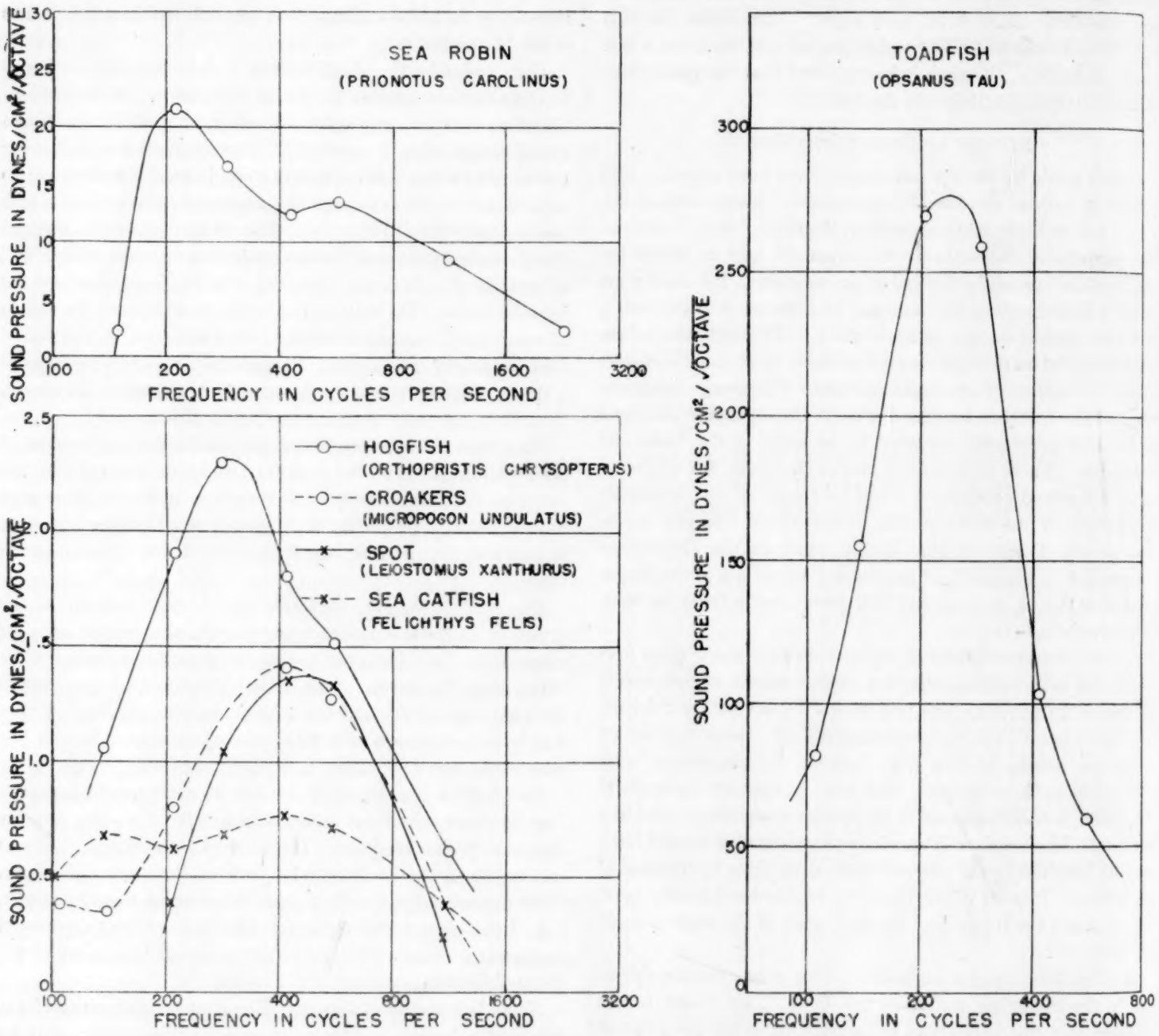

FIG. 3. Spectra of noise produced by segregated groups of sonic fish.

The sound of the sea robin might best be described as a modulated, rhythmic squawk, squeal, or cackle, resembling noises ordinarily associated with a barnyard. The curve in Fig. 3 gives the frequency characteristics and level for the case of a single specimen in a highly reflecting concrete pool.

Sea robin noises were frequently heard in the course of the open-water listening tests both at Piver's Island and Fort Macon, particularly at the latter location. They were also discernible during offshore listening tests past Cape Lookout. It was never possible in field measurements to determine sound

sea catfish is a significant noisemaker. It makes a rhythmic drumming noise like the beating of a tom-tom, differing from the drumming of the croaker in that it comes not in rolls but in rapid, evenly-spaced beats. This noise was heard under natural conditions at Fort Macon and in Bogue Sound, near Morehead City. For this study measurements were made on four catfish in an experimental enclosure.

The motivation for noise production by marine life lies outside the scope of this paper. Further light on it, however, should make possible a more substantial knowledge of behavior patterns in sonic species.

The disc recordings made in connection with water listening described above as well as in the tests on segregated fish are available in the Naval Ordnance Laboratory's files. Dubbings can be made available to any biological laboratory which can put them to use.

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Portable Glycol Vaporizers for Air Disinfection[1]

F. C. W. Olson, Edward Bigg, and Burgess H. Jennings

Northwestern Technological Institute and *Department of Medicine, Northwestern University Medical School*

The promising results of recent studies (*3*, *5*, *6*) on the use of propylene glycol and triethylene glycol vapors for air sterilization have created a need for portable and inexpensive glycol vaporizers for constant or intermittent use in small spaces such as operating rooms, two- or three-bed hospital wards, laboratories, classrooms, etc. Vaporizers in present use (*1*, *4*) are suitable for large spaces, as dormitories, auditoriums, assembly halls, office and factory buildings. While they fulfill the requirements for generation of vapors at a constant rate, size and cost limit their use to relatively large installations.

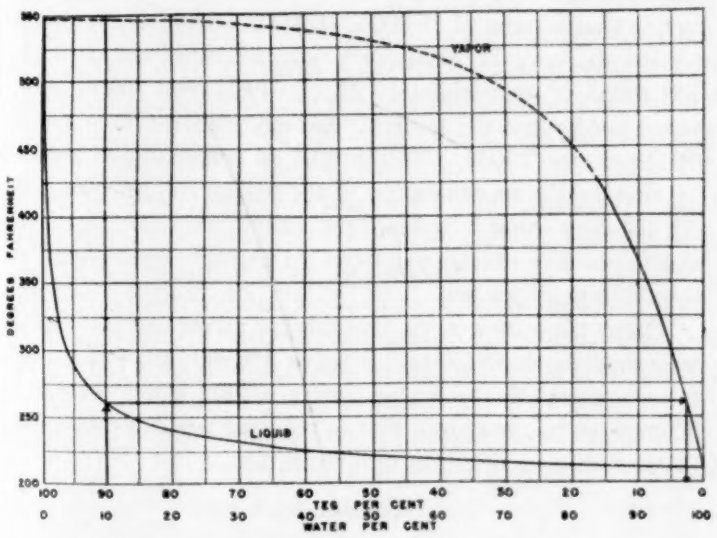

Fig. 1

From study of the temperature-composition diagram of glycol-water solutions (Fig. 1), it may be seen that the relative proportions of vapors emitted from a boiling mixture are dependent upon the concentration of the solution. The total vapor output will depend upon the heat input (rate of boiling). A method for controlling the concentration of the solution would, of necessity, determine the ratio of glycol and water vapor emitted. We have utilized two such control measures in the devices described below.[2] It should be pointed out that while only triethylene glycol (TEG) is mentioned in the description, the apparatus may also be used with propylene glycol (PG) if the different boiling temperature of PG is considered.

The portable vaporizer shown in Fig. 2 retains the essential features of the larger field model, but replaces the expensive and bulky thermoswitch-solenoid valve control system with a thermostatic bellows directly connected to a small valve. A low-pressure water line, which may be an aspirator bottle, is connected to the water inlet. The bellows is filled with a TEG-water solution in equilibrium with the desired concentration in the liquid container. For satisfactory operation, the bellows should be completely immersed and the valve must be above the surface of the liquid.

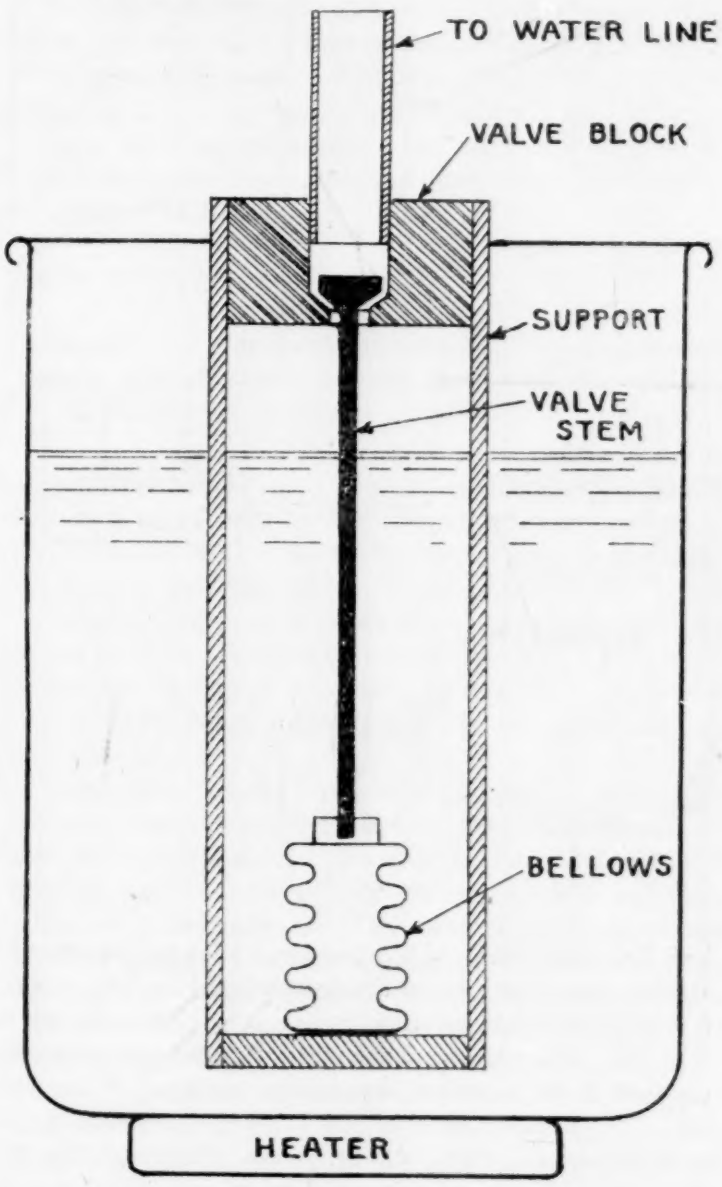

Fig. 2

The container has a capacity of approximately two quarts. It is preferably heated by a disk type three heat coil (100, 200, 400 watts) mounted beneath the vaporizer. An immersion heater may also be used, although it may not be quite as convenient.

To illustrate the mode of operation, assume we wish to vaporize TEG at 290° F. From the temperature-composition diagram, a solution of 4.7 per cent water and 95.3 per cent TEG boils at 290° F., and the corresponding water output is about 96 per cent water and 4 per cent TEG. The bellows is accordingly filled with a 95.3 per cent TEG solution and sealed.

[1] The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Northwestern University.

[2] Patent applications made and assigned to Northwestern University.

A solution of the same composition is placed in the vaporizer. As heating progresses, the vaporizer TEG concentration increases, due to the loss of water, and consequently the boiling point of the liquid also rises. This rise in temperature vaporizes the solution in the bellows, causing it to expand and open the valve, admitting water into the solution. The added water lowers the boiling point of the solution, cooling the bellows, which then contracts and closes the valve. On continued heating this cycle is repeated, maintaining the concentration within close limits.

The vaporizer shown in Fig. 3 uses a modification of the well-known "chicken feeder" principle. A copper tube (about $\frac{1}{8}$ inch inside diameter and 6 inches long) joins the vaporizer at a point about $\frac{1}{2}$ inch below the desired liquid level to an open feed cup in which an inverted large-mouthed reservoir bottle is mounted. The purpose of the rather long tube is to prevent the heat of the vaporizer from boiling the liquid in the feed cup. The bottle is filled with a TEG-water solution of the same proportions as desired in the vapors to be given off by the vaporizer. For example, since the vapors from a boiling 95.3 per cent TEG solution will consist of 96 per cent water and 4 per cent TEG, if the reservoir is filled with a 4 per cent TEG solution, it will automatically replace in the vaporizer the proper quantities of water and TEG, since the feeder action acts as a constant-level device.

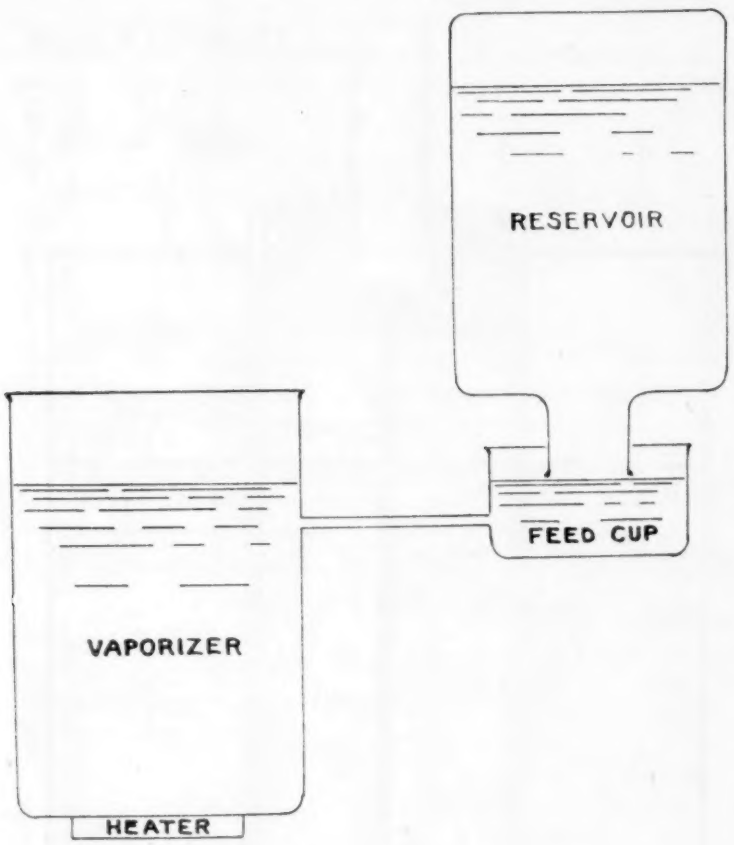

FIG. 3

It should be pointed out that even if the concentrations in the vaporizer and in the reservoir do not correspond to those in the temperature-composition diagram, the vaporizer concentration will approach a value determined by the reservoir concentration, so that eventually the two concentrations will correspond to those in the diagram. The reservoir concentration, however, is the controlling factor.

In permanent installations where glycol generators are connected to duct systems of known capacity or incorporated into air-conditioning systems, the necessary calculations to obtain an optimum TEG concentration of 0.003–0.005 mg./l. of air may be made with a fair degree of accuracy. Such a close control of concentration is not possible with the portable models herein described.

We would suggest that the vaporizer be placed in the room to be treated, either on the floor or on a table, in such a manner that air currents will distribute the vapors uniformly. A small, oscillating fan mounted behind the vaporizer may be helpful. The apparatus should then be turned on at high heat (400 watts) and allowed to operate until a slight fog becomes noticeable, at which time it is either turned to a lower heat or disconnected.

The space which may be treated by one of these devices will be dependent not only on its size but the degree of air infiltration and exfiltration which occurs within it. It is our feeling that a room of 15,000–20,000 cubic feet, under normal conditions, may be adequately treated, since the output at 400 watts is approximately 11 cc. TEG and 360 cc. water vapor per hour if the reservoir boiling temperature is 290° F. (95.3 per cent TEG). This output, of course, may be varied by altering the concentration of the boiling solution or changing the heat input. It will take individual adjustments and observations to adapt a vaporizer for a specific space, but these should be readily made.

These vaporizers offer the specific advantage over other suggested methods for glycol vapor generation by the simultaneous generation of water from a boiling aqueous solution. This serves two purposes, that of reducing possible fire hazards (*2*) and that of aiding in humidification.

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Scanning Science—

The new catalogue of Harvard University shows a registration of 3,674 students, an increase of 74 over last year. There has been a slight decrease in the College, but a gain in the Lawrence Scientific School, in the Graduate School and in the Medical School. There has been an increase of 4 professors and 17 instructors.

—January 1, 1897

Book Reviews

Mental disorders in later life. Oscar J. Kaplan. (Ed.) Stanford Univ.: Stanford Univ. Press, 1945. Pp. vii + 436. (Illustrated.) $5.00.

Within the last few years physicians, psychologists, sociologists, biochemists, and physiologists have come to see the importance of diseases peculiar to old age, and a large number of publications has appeared dealing with various aspects of the problem of geriatrics. It is obvious that these different phases of the subject are closely interrelated and must be considered in an integrated fashion if they are to bring positive results. It is gratifying, therefore, to see that the editor of this book has been able to enlist the aid of well-known authorities on the subject and has produced an integrated presentation of most of its important phases. As is always the case in contributions of this type, its separate chapters vary both in importance and quality of the presentation.

The most valuable of the chapters are those dealing with the physiological aspects of these diseases, the psychological investigations, the neuroses of later maturity, the psychoses occurring at this age, the psychosomatic problems, and the psychotherapeutic methods. It is interesting to note that in all of these there seems to be a consensus as to what constitutes the important nucleus of the problem, and we are impressed particularly by the following points:

(1) The maladjustments associated with old age are not so much dependent upon actual destruction of tissue as they are upon the disturbances in homeostasis.

(2) The disturbances in old age cannot be said to be due primarily to either organic changes or the impact of social problems but must be regarded as the result of a combination of both.

(3) Both the neuroses in general and the psychosomatic disturbances in particular, occurring at this age, may be of two types: those that are encountered at any age, and those that are especially characteristic of the later years.

(4) Finally, and perhaps the most hopeful feature as far as practical therapy is concerned, are the points brought out both in the chapter on neuroses and that on treatment—that psychotherapeutic efforts are definitely worth while and can be successful in old age.

Some of the chapters leave us with the feeling that not enough stress has been placed on points of importance. This is true, for instance, of the chapter on sociological aspects, where the broad social implications of age and the attitudes of society in general are not brought out as sharply as one would wish, and of that on the problems of nutrition in old age, which is entirely too short and too superficial to be of as much value as one would have expected.

Finally, there are two chapters that leave one with the question as to whether they really belong in this book. One is a chapter on older mental patients after long hospitalization, which in itself is an excellent contribution but has really not much bearing on the problem of aging. The other is the chapter on toxic deliria in which entirely too much space is devoted to the discussion of extraneous subjects and polemics.

There is a brief introduction by Dr. Karl Bowman which presents the general aspects of the problem and a very thoughtful concluding chapter by Dr. E. J. Stieglitz on systematic orientation. On the whole, the book makes a very good impression and is recommended to the reader as a very worthwhile contribution to the studies of personality disturbances in later maturity.

WILLIAM MALAMUD

Boston University School of Medicine

Industrial and commercial geography. (3rd ed.) J. Russell Smith and M. Ogden Phillips. New York: Henry Holt, 1946. Pp. xiii + 978. (Illustrated.) $4.90.

Textbooks are so characteristically dull that it is a relief to read one which maintains a high level of interest for more than 900 pages. The volume surveys the industries of the world as they have been affected by the Power Age. In an undertaking so comprehensive, this is a feat worthy of note.

The effectiveness of the book must be attributed in large part to the authors' ability to write readable English. By vivid writing they succeed in convincing the reader that man's relation to his environment is a dynamic subject, not a static or dead concept.

Starting with a brief survey of energy sources and fundamental factors affecting manufacture, the authors describe in turn the great industries of the world for each continent. The fuels are presented first and are followed by iron and steel, other metals, and nonmetals. This sequence has the advantage of focusing attention on the basic industry, but has a disadvantage in that the topics of forestry, agriculture, animal industries, and fishing are apt to seem anticlimactic. Smith and Phillips avoid this pitfall by close integration between subjects and by stressing the perpetual nature of agriculture. The ultimate exhaustion of all mineral deposits emphasizes the fact that, historically, agriculture was the first industry developed, and in the final analysis it may prove to be the mainstay of civilization. It is possible that an historical approach, starting with agriculture and building up to the climax, the iron and steel industry, might have strengthened this tenet and added an element of suspense, thus giving greater unity to the volume.

The description of the world's resources and industries occupies 733 pages. The final section, which presents an analysis of world commerce, unfortunately contains the only conspicuously poor writing in the book. There are some involved sentences, and occasionally the authors' meaning is given a ludicrous connotation that certainly was never intended. For

example, on page 813, appears the statement: "It (the reindeer) is a great aid to prospectors and miners in the search for minerals in which Alaska and northern Canada seem to be promising." The casual reader is left with the impression that the prospectors are using reindeer as super-bloodhounds for tracking down new mineral localities.

The chief criticism of *Industrial and commercial geography* concerns a fact that lies beyond the control of the authors, namely, consideration of the prewar period as the norm. Because of the dynamic nature of geography, it is doubtful whether conditions can revert entirely to their prewar state.

It is regrettable that the pictures are so poorly reproduced. The graphs and maps are numerous and generally illuminating. The information on some of the maps is so microscopic that it is undecipherable. The method of numbering illustrations by pages is highly commended, since this saves both the reader's time and temper.

This book should prove effective as a text, because of its wealth of information and its readability, and valuable as a reference to students of economics, sociology, and government as well as to geographers.

ELIZABETH W. OLMSTED
Smith College, Northampton, Massachusetts

La pathologie des oiseaux. G. Lesbouyries. Paris: Vigot Frères, 1941. Pp. 868. (Illustrated.) 1,000 fr.

The author of this work is a professor of veterinary medicine, and the title is likely to prove misleading to ornithologists seeking information on diseases of wild birds. Nevertheless, the book should receive notice outside its strict field because of its extremely detailed treatment of a broad range of infectious maladies, some of which are associated with manifestations in nature.

Dr. Lesbouyries calls attention to the fact that investigation of avian disease has been responsible for a number of important advances in the history of medicine. He then discusses, in order, malnutritions, tumors, infections (virus, bacterial, protozoan, fungus), malformations, glandular affections, endo- and ectoparasites, etc. Each disease which has received a name is minutely described in terms of symptoms and cellular pathology, and its history, treatment, and prophylaxis are adequately discussed, at least in so far as they relate to barnyard fowl. Mention of other birds is scanty, and references to parrots, crows, penguins, quail, falcons, eagles, owls, doves, magpies, larks, and finches seem to be drawn entirely from literature rather than from firsthand clinical esperience.

Despite its wealth of information for those who wish to search it out, nonmedical ornithologists will deeply regret the lack of a table of contents, an index, and a bibliography. Authors and the dates of their publications are cited in profusion, but the absence of a formal bibliography is excused on the ground that it would "submerge the text" of the huge volume.

The reader seeks in vain for accounts of spectacular pandemics among wild populations, such as the Peruvian guano fowl, the fulmars of the North Atlantic, and the wild ducks of the western United States, all of which have become the subjects of a considerable scientific literature.

ROBERT CUSHMAN MURPHY
American Museum of Natural History, New York City

Scientific Book Register

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